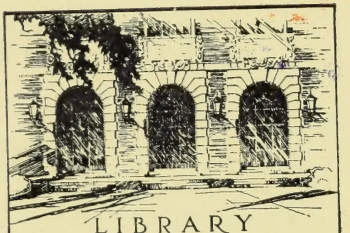

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UNIVERSITY OF ILLINOIS

DEPARTMENTS AT URBANA

GRADUATE SCHOOL ANNOUNCEMENT

1947-1948

UNIVERSITY OF ILLINOIS BULLETIN

UNIVERSITY OF ILLINOIS BULLETIN

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UNIVERSITY OF ILLINOIS

Departments at Urbana

GRADUATE SCHOOL ANNOUNCEMENT

1947-1948

PUBLISHED BY THE UNIVERSITY OF ILLINOIS
URBANA · September, 1947

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Note: The general offices of the University are open weekdays
from 8 a.m. to 12 m. and from 1 to 5 p.m.
except Saturday afternoon

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1947/48-1950

CONTENTS

PAGE

Board of Trustees 2
Executive Faculty of the Graduate School 5
Graduate School Calendar 6
Heads and Chairmen of Departments Giving Graduate Work 8
History and Organization 9
Admission 9
Character of Graduate Work 9
Registration and Program of Studies 10
Masters' Degrees 12
Second Degrees in Engineering 14
Professional Degrees in Education 16
Degree of Doctor of Philosophy 17
Degree of Doctor of Philosophy in Engineering 20
Agricultural and Engineering Experiment Stations 20
Scholarships, Fellowships, and Assistantships 20
Libraries 22
Fees and Expenses 23

Departments of Instruction

Agricultural Economics 25
Agricultural Engineering 27
Agriculture 27
Agronomy 28
Animal Science 29
  Animal Science 30
  Animal Nutrition 30
Architecture and Architectural Engineering 31
Art 32
Astronomy 33
Bacteriology 33
Biological Sciences 34
Botany 35
Business Organization and Operation 37
  Accountancy 37
  Business Law 38
Ceramic Engineering 38
Chemistry 39
  Chemical Engineering 44
Civil Engineering 45
Classics 48
  Greek 48
  Latin 49
Commerce 50
Dairy Husbandry 50
Economics 51
Education 54

CONTENTS (Concluded)

PAGE

Electrical Engineering 57
English Language and Literature 59
Rhetoric 61
Entomology 62
French 62
Genetics 63
Geography 63
Geology 64
German 66
History 67
Home Economics 69
Horticulture 71
Humanities 72
Journalism 73
Landscape Architecture 73
Library Science 75
Mathematics 77
Mechanical Engineering 79
Mining and Metallurgical Engineering 80
Music 81
Philosophy 83
Physical Education 84
Physical Sciences 85
Physics 85
Plant Pathology 87
Political Science 87
Psychology 89
Social Sciences 91
Social Welfare Administration 92
Sociology 94
Spanish and Italian 95
Portuguese 97
Speech 97
Theoretical and Applied Mechanics 99
Veterinary Pathology and Hygiene 100
Zoology and Physiology 100
Index 105

THE GRADUATE SCHOOL
EXECUTIVE FACULTY

3-17-2

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Neil Everett Stevens, Ph.D., Professor of Plant Pathology

CALENDAR

1947

Summer Session

June 6, Fri.—June 7, Sat., 12 M. . . . . Registration days
June 11, Wednesday . . . . . Instruction begins.
June 28, Saturday . . . . . Latest date to apply for French and German examinations.
July 4, Friday . . . . . Independence Day (holiday).
July 11, Friday . . . . . Examination in French.
July 18, Friday . . . . . Examination in German.
July 26, Saturday, 12 M. . . . . Latest date for candidates for degree in August to deposit theses.
August 1, Fri.—August 2, Sat. . . . . Examinations in eight-week courses.
September 8, Monday . . . . . Latest date for candidates for Ph.D. degree in October to deposit theses.
September 8, Monday . . . . . Latest date for filing application for masters' degrees to be conferred in October.
September 22, Monday . . . . . Latest date for finals for Ph.D. degrees.
September 22, Monday . . . . . Latest date for candidates for masters' degrees in October to deposit theses.
September 26, Fri.—September 27, Sat. . . Examinations in sixteen-week courses.
October 5, Sunday . . . . . Baccalaureate and Commencement exercises.

First Semester

October 3, Fri.—October 4, Sat., 12 M. . . . Registration days.
October 4, Saturday . . . . . Latest date for registration of former students without penalty.
October 4, Saturday . . . . . Latest date to apply for French and German examinations.
October 9, Thursday, 8 A.M. . . . . Instruction begins.
October 17, Friday . . . . . Examination in French.
October 24, Friday . . . . . Examination in German.
October 25, Saturday . . . . . Latest date for changing study-lists without fee.
November 1, Saturday . . . . . Latest date for preliminary examination (for full residence).
November 1, Saturday . . . . . Latest date for candidates for professional engineering degrees to file statements of professional study and experience.
November 26, Wednesday, 12 M. . . . . Thanksgiving vacation begins.
December 1, Monday, 1 P.M. . . . . Thanksgiving vacation ends.
December 20, Saturday, 1 P.M. . . . . Christmas vacation begins.
December 31, Wednesday . . . . . Latest date for candidates for professional engineering degrees to submit outlines of theses.

1948

January 5, Monday . . . . . Latest date for filing applications for masters' degrees to be conferred in February.
January 5, Monday, 7 A.M. . . . . Christmas vacation ends.
January 19, Monday . . . . . Latest date for candidates for Ph.D. degree in February to deposit theses.
January 30, Fri.—February 7, Sat. . . . . Semester examinations.
February 2, Monday . . . . . Latest date for finals for Ph.D. degrees.

February 2, Monday ..... Latest date for candidates for masters' degrees in February to deposit theses.
February 6, Friday ..... Latest date to apply for French and German examinations.
February 15, Sunday ..... Baccalaureate and Commencement exercises.

Second Semester

Feb. 13, Fri.—Feb. 14, Sat., 12 M. ..... Registration days.
February 14, Saturday ..... Latest date for registration of former students without penalty.
February 16, Monday ..... Latest regular date for applications for scholarships and fellowships for 1948-1949.
February 18, Wednesday ..... Instruction begins.
February 20, Friday ..... Examination in French.
February 27, Friday ..... Examination in German.
February 28, Saturday ..... Latest date for preliminary examination (for full residence).
March 6, Saturday, 12 M. ..... Latest date for changing study-lists without fee.
March 25, Thursday, 1 P.M. ..... Easter vacation begins.
March 29, Monday, 1 P.M. ..... Easter vacation ends.
April 1, Thursday ..... Latest date for filing applications for masters' degrees to be conferred in June.
April 3, Saturday, 12 M. ..... Latest date to apply for French and German examinations.
April 16, Friday ..... Examination in French.
April 23, Friday ..... Examination in German.
May 1, Saturday ..... Latest date for candidates for professional engineering degrees to deposit theses.
May 15, Saturday ..... Latest date for filing applications for masters' degrees to be conferred in August.
May 24, Monday ..... Latest date for candidates for Ph.D. degree in June to deposit theses.
June 2, Wed.—June 10, Thurs. ..... Semester examinations.
June 7, Monday ..... Latest date for candidates for masters' degrees in June to deposit theses.
June 7, Monday ..... Latest date for finals for Ph.D. degrees.
June 20, Sunday ..... Baccalaureate and Commencement exercises.

Summer Session

June 18, Fri.—June 19, Sat., 12 M. ..... Registration days.
June 23, Wednesday ..... Instruction begins.
August 13, Fri.—August 14, Sat. ..... Summer Session examinations.

Notes

Examination in one foreign language must be passed before residence on second year may be counted (pages 13, 18).
Two copies of thesis are required of candidates for masters' and doctors' degrees (pages 13, 19).
Candidates for masters' degrees announce thesis subjects at beginning of second half-year of work, or after completion of four units, or at beginning of third summer session (page 13).
Candidates for Ph.D. degree announce thesis subjects within six weeks after beginning of third year of residence (page 19).
Candidates for Ph.D. degree deposit theses two weeks before date of final examination (page 19).

HEADS AND CHAIRMEN OF DEPARTMENTS GIVING GRADUATE WORK

Accountancy	Hiram Thompson Scovill
Agricultural Economics	Harold Clayton M. Case
*Agricultural Engineering	Emil Wilhelm Lehmann
Agronomy	William Leonidas Burlison
Animal Science	Leslie Ellsworth Card
*Architecture (and Architectural Engineering)	Loring Harvey Provine
*Art	Frank John Roos, Jr.
*Astronomy	Robert Horace Baker
Bacteriology	Fred Wilbur Tanner
Botany	Oswald Tippo (Acting)
*Business Organization and Operation	Hiram Thompson Scovill
Ceramic Engineering	Andrew Irving Andrews
Chemistry	Roger Adams
Civil Engineering	Whitney Clark Huntington
Classics	Revilo Pendleton Oliver (Executive Secretary)
Dairy Husbandry	Glenn Wade Salisbury
Economics	Merlin Harold Hunter
Education	Willard B. Spalding
Electrical Engineering	William Littell Everitt
English	Henning Larsen
Entomology	Clell Lee Metcalf[1] William Patrick Hayes (Acting)
French	Joseph Francis Jackson
*Geography	
Geology	George Willard White
German	Helmut Rehder
History	Theodore Calvin Pease
*Home Economics	J. Lita Bane
Horticulture	Maxwell J. Dorsey
*Journalism	Fredrick Seaton Siebert
*Landscape Architecture	Otto George Schaffer
*Library Science	Robert Bingham Downs
Mathematics	Henry Roy Brahana (Acting)
Mechanical Engineering	Norman Alwyn Parker
Mining and Metallurgical Engineering	Harold Leroy Walker
*Music	John Marinus Kuypers
Philosophy	Matthew Thompson McClure
*Physical Education	Seward Charle Staley
Physics	Francis Wheeler Loomis
Political Science	Clarence Arthur Berdahl
Psychology	Herbert Woodrow
*Social Welfare Administration	Marietta Stevenson
Sociology	John William Albig
Spanish and Italian	John Van Horne
Speech	Karl Richards Wallace
Theoretical and Applied Mechanics	Fred B. Seely
Veterinary Pathology and Hygiene	Robert Graham
Zoology and *Physiology	

* Give work for masters' degrees only. [1] On leave of absence.

THE GRADUATE SCHOOL

History and Organization

The University of Illinois offered facilities for advanced study and research in various lines as early as 1872. Organized graduate instruction, however, under the name of the Graduate School, was first undertaken in 1892. In 1894 the administration of the school was vested in the Council of Administration, and the Vice-President of the University became Dean of the School. In 1906 the Graduate School was organized as a separate faculty.

By action of the Trustees the teaching faculty of the Graduate School includes all members of the University Faculty who give instruction in approved graduate courses. The affairs of the School, however, are in charge of the Executive Faculty.

Admission

Admission to the Graduate School may be granted to graduates of institutions whose requirements for the bachelor's degree are substantially equivalent to those of the University of Illinois and to applicants from other institutions approved by the Executive Faculty, as hereinafter provided. *Admission to the Graduate School, however, does not imply admission to candidacy for an advanced degree, and gives the student no right or claim to be so admitted. A mere accumulation of "credits" or "grades" is not sufficient.*

Admission to graduate courses may be granted only to those who have had the requisite undergraduate work in those courses or departments; students whose preparation is considered inadequate may be required to take without credit certain undergraduate courses. But a student of mature age who satisfies the Dean and the department concerned of his ability to pursue graduate work in a given line may be enrolled in particular graduate courses, without reference to a degree, and permitted to carry on such study or investigation under the direction of a department of the University as the department shall recommend and the Dean approve.

Application blanks for admission may be obtained from the Director of Admissions and Records of the University. Every applicant must submit with his application for admission an official transcript of his college record. All applicants who have not previously taken a physical examination at the University must take such an examination. The examination is given by the University Health Service without cost to the student, if taken at the time of appointment during the registration period.

Character of Graduate Work

The principal aims of graduate study are the development of the power of independent work and the promotion of the spirit of research. Each candidate for a degree is expected to have a wide knowledge of his subject and of related fields of work. The graduate student is not expected to get from lecture and laboratory courses all the knowledge and training necessary to meet the requirements for his degree.

Registration and Program of Studies

Registration. — Each graduate student must register at the beginning of each semester. The registration of a new student may be accepted at any time provided the student is prepared to take up courses already under way. Credit towards the fulfillment of the residence requirement dates, however, from the time of registration and not from the beginning of the semester or year in which the student enters.

A new student must fill out in duplicate an application for admission and submit it to the Director of Admissions and Records, from whom, after the approval of his application, he will receive a card of admission and a study-list which will give details of procedure in registering. He should fill out the study-list after consultation with his adviser, or the person in charge of his major work, and also with the instructors whose courses he wishes to elect. *Registration, including the payment of fees, must be completed by the close of the registration days of the Graduate School. Otherwise a fee of $5.00 for late registration will be charged all former students of the University of Illinois.*

Changes in Study-lists. — A graduate student is expected to plan his work so carefully that changes in his study-list during the semester will not be necessary. When a change seems advisable, however, it may be permitted without fee if made within three weeks of the date of registration. After that date a fee of one dollar is charged for each change, except that the total charge for rearrangement authorized on any one change slip shall not exceed two dollars.

Advanced Undergraduate Courses Open to Graduate Students. — The amount of graduate credit appropriate to these courses ranges from one-fourth to one unit. In the more elementary courses it should not exceed one-half unit. The actual amount in each case should be specified on the student's program by the department concerned, and is subject to approval by the Dean. Courses which are regularly open to sophomores may not be taken for graduate credit.

Seniors and Graduate Study. — If at the beginning of the second semester of his senior year a student who has been in residence at least one year is within five hours of a bachelor's degree, he may be permitted to register for courses which may count for residence for a master's degree, provided his program is limited to approximately twelve formal class, lecture, or laboratory exercises a week, and is approved by the Dean at the time of registration. Only students of excellent record will be allowed this privilege.

Miscellaneous and Listeners' Courses. — A graduate student in full standing and carrying a minimum program, may be permitted, under proper circumstances, to elect one miscellaneous subject (that is, a course which does not count towards an advanced degree). No subject is open as a miscellaneous course unless it has a specific educational bearing on the student's major or minor subjects of study. A student who elects a miscellaneous course is required to register in it, do the work, and pass the semester examinations, unless he is permitted to withdraw under the rules.

Graduate students are permitted to attend classes as listeners, providing a card bearing the approval of the adviser and instructor is filed at the Graduate School office. A student who attends as a listener is not permitted to participate in the class work or the examination. No student may register for a full

minimum program of work for graduate credit if it is necessary for him to carry at the same time more than one miscellaneous subject.

Students on the Staff. — Assistants and others on the University staff who undertake to do graduate work are permitted to take an amount of work determined by the terms of their employment. Such a student, if required by his engagements to teach more than five classes a week or to have laboratory work or supervision exceeding ten hours a week, will find it impossible to complete the work for a master's degree in one year, or a doctor's degree in three years.

Extramural Work. — Students who began their extramural graduate work in September, 1941, or thereafter, may apply no more than four units of graduate credit earned through extramural courses toward meeting the requirements of the degree of Master of Arts or Master of Science.

Credit earned in extramural courses may be applied toward graduate work beyond the masters' degrees only in individual cases, and upon approval of the Deans of the College and of the Graduate School. Such approval must be obtained not later than the time of registration for such course.

Residence and Work Done Elsewhere. — Continuous residence and study are required of all members of the Graduate School, unless they are granted leave of absence by the Dean, upon recommendation of the professor in charge of their work, for the purpose of carrying on elsewhere studies or investigations in the line of work for their degrees.

Graduate Study in the Summer. — Graduate students in the summer session are subject to the same scholastic requirements as those in the regular University year. Their study-lists must be approved by the Dean of the Graduate School, or his representative. Two to two and one-half units of graduate work may be taken in the summer session. Two units is considered a full minimum program for the summer. Attendance during four out of six consecutive summer sessions, or one semester and two summer sessions, is considered the equivalent of one year in residence. No course offered in the summer session may be taken for credit towards a higher degree unless it is described in the summer session circular as accepted for that purpose.

The Executive Faculty may, at the request of a given department, accord recognition to its summer session work subject to the following conditions: (1) Study in the University of Illinois summer session may be counted in partial fulfillment of the residence requirements for the degree of Doctor of Philosophy, but at least one continuous academic year of residence at the University at some time during the second or third years of the doctoral program is required. (2) Persons electing to use this plan shall be required to submit a schedule of study covering the second and third years of work toward the doctorate. This schedule of study must be approved by the adviser in charge of the major subject and by the Dean of the Graduate School. (3) Apart from the provisions stated above, the present practices and standards of the Graduate School relating to the doctorate shall be continued.

Graduate Work in Medical and Dental Sciences and Pharmacy. — Graduate courses in medical and dental sciences and in pharmacy are offered in the Colleges of Medicine, Dentistry, and Pharmacy of the University of Illinois. Circulars describing the courses offered and conditions of admission and work

may be obtained from the Committee on Graduate Work in the College of Medicine, 1853 West Polk Street, Chicago 12.

Failures. — A graduate student who fails in any course in his major subject can not secure his degree in the same year in which the failure occurred. No condition examinations are given graduate students.

Withdrawal. — If after registration a graduate student wishes to withdraw from any course or to add other work, he must first secure the necessary papers from the Dean's office. See the regulations concerning changes in study-lists, page 10. If he wishes to withdraw from the University he must get clearance papers at the Dean's office.

Masters' Degrees

Character of Masters' Degrees. — The master's degree conferred on a candidate depends on the character of the baccalaureate degree, the usual practice being that A.M. shall follow A.B., and that M.S. shall follow B.S. However, this practice may be departed from in cases where the candidate's undergraduate course of study was of a kind for which some reputable institutions in this country give A.B., while others give B.S. In music M.Mus. shall follow B.Mus., and in the fine arts M.F.A. shall follow B.F.A.

Amount of Work Required. — Candidates for the degree of Master of Arts or Master of Science are required to do at least one full year's work in residence, usually including a thesis. Four to five units constitute a normal semester program for the master's degree. A minimum of eight units must be completed for the degree. Only first-rate students are permitted to secure a degree with this minimum program. In some departments special examinations are required of candidates for masters' degrees. In all cases, the student must satisfy the duly approved conditions set by his major and minor departments.

Unless otherwise permitted, every student must take each semester at least one course open to graduate students only (courses numbered 100 and upwards).

In the first year of his graduate study each student is required to attend a minimum of four formal class, lecture, or laboratory exercises a week. Schedules involving an unusually large number of formal class meetings each week will require the special approval of the Dean.

Work Done Elsewhere. — Members of the staff and high school teachers residing and employed in Urbana or Champaign who have done graduate work in approved institutions elsewhere may secure credit not to exceed four units towards the master's degree by passing examinations in that work. Admission to such examinations requires the prior approval of the Dean of the Graduate School. They may complete the work for the degree by securing at least four units more while registered in the Graduate School for not less than one academic year.

Graduate students who have been in residence one semester or its equivalent may offer for credit not more than nine weeks of work at a marine or fresh-water biological laboratory or in biological or geological field work, on condition that the work be of graduate grade under a qualified instructor or director as certified by the student's major adviser and approved by the Dean of the Graduate School; that approval be obtained by the student in advance; and that a written report of the work accomplished be presented by the student and approved as satisfactory by the student's major adviser.

Majors and Minors. — A candidate for a master's degree may do all his work in one subject, or he may select a major and one minor, or a major and two minors. A major or minor denotes the field of knowledge of a department, or such part thereof as constitutes a separate and independent division of that field. For a master's degree a major is at least half the work, or a minimum of four units, for one year. Less than one unit may not be counted as satisfying the requirements of a minor without the approval of the department concerned.

Foreign Language. — The ability to use one or more of the modern languages ordinarily studied in the undergraduate curriculum is desirable for all candidates for the master's degree, and in some lines of study is required. No student will be permitted to acquire residence toward the second year for the doctorate until he has passed the preliminary examination in at least one of these languages.

Masters' Theses. — Each candidate for a master's degree is required to present two copies of a thesis on some subject approved by the professor in charge of his major work. Such approval, except in case of students working for masters' degrees in summer sessions only, must be secured and the subject of the thesis filed at the office of the Graduate School not later than the beginning of the second half-year of residence. Students working for masters' degrees exclusively in summer sessions must announce their thesis subjects not later than the beginning of their third session in residence. The requirement of a thesis may be waived, however, on the recommendation of the professor in charge of his major work and the approval of the Dean, *provided application to waive the thesis is made at the time for announcing thesis subjects.* A student excused from writing a thesis must replace it with courses of instruction.

No one will be excused from writing a thesis unless one-half of his program of studies consists of courses numbered 100 and upwards.

The thesis required from a candidate for a master's degree will ordinarily demand from one to two units of work, and may not exceed three units except by special permission. The thesis must be typewritten, on "thesis paper,"[1] and the title page must be printed. The carbon copy may be on plain paper of approximately the same weight as the thesis paper. Both copies of the thesis in its final form, together with a certificate of approval by the proper officer, must be left at the Dean's office at least two weeks before the date on which the degree is to be conferred. No article prepared for another use, or previously published, will be accepted as a thesis.

Permission for the publication of the material of a master's thesis should be obtained from the Dean of the Graduate School before such publication is carried out.

Applications for Degrees. — Each candidate for a master's degree shall file an application for the degree on a blank provided for the purpose, to be had at the Dean's office. For the dates of applications and of deposition of theses, consult the calendar at the beginning of the bulletin.

Degrees in August. — Students who have completed at least six units and who expect to finish their work during the summer session and to take the master's degree in August may be recommended at the June meeting of the Senate subject to successful completion of the work for which they are to register

[1] No other will be accepted by the Dean. "Instructions for the Preparation of Theses" may be obtained at the Dean's office.

in the summer session, provided they file with the Graduate School before May 15 an application for the degree.

Thesis Work on Leave of Absence. — Under proper conditions a student may be permitted to complete the last fourth of his work, if devoted to his thesis, under leave of absence for a period not to exceed the equivalent of two semesters. To get such permission the student must have secured credit for at least six units; must petition for the privilege; must submit to the Dean an outline of the proposed investigation, approved by the professor in charge of his major work, and must submit satisfactory evidence that adequate facilities are available to him at the place where he intends to do the proposed work. Approval on all these points must be obtained one collegiate year before the thesis is due. Immediately following approval the student must register and pay a tuition fee of $20.

Grades. — Students' work is graded in five classes, A, B, C, D, and E. The last indicates a failure. D indicates unsatisfactory, though passable, work.

A student who receive two units of a grade below B during his first year of graduate work may not complete the first year of residence by carrying the minimum program of eight units for the master's degree. Three units of a grade below B disqualify a student as a candidate for a degree.

A failure or absence from examination in any course or failure in any other examination prescribed by the department of the major may prevent the conferring of the degree; and, as already indicated, failure in any course in the major field precludes the conferring of the degree in the same year.

Teacher-Education Programs. — Programs leading to the master's degree in teacher education are offered to students who have satisfactorily completed the four-year teacher-training programs, or their equivalents. These programs are offered in the following areas: agriculture, art, biological sciences and general science, chemistry, commercial teaching, English, French, geography, German, home economics, Latin, mathematics, mathematics and the physical sciences, music, physical education, physical sciences, physics, social studies, Spanish, and speech.

Students who have not met all of the requirements of a four-year undergraduate curriculum but who desire to take the fifth year of work may register, on approval, and make up deficiencies while pursuing the fifth year.

Second Degrees in Engineering

Two classes of second degrees are open to graduates of the College of Engineering, namely, academic and professional.

The *academic* second degree in engineering is Master of Science, following Bachelor of Science, in civil engineering, electrical engineering, etc. This degree is conferred in accordance with the regulations described above for *academic work in residence only.*

The *professional* second degrees in engineering are as follows:

Agricultural Engineer, after B.S. in agricultural engineering.

Master of Architecture, after B.S. in architecture.

Architectural Engineer, after B.S. in architectural engineering.

Ceramic Engineer, after B.S. in ceramic engineering.

Chemical Engineer, after B.S. in chemical engineering.

Civil Engineer, after B.S. in civil engineering or in railway civil engineering.

Electrical Engineer, after B.S. in electrical engineering or in railway electrical engineering.

Mechanical Engineer, after B.S. in mechanical engineering or in railway mechanical engineering.

Metallurgical Engineer, after B.S. in metallurgical engineering.

Engineer of Mines, after B.S. in mining engineering.

Engineer-Physicist, after B.S. in engineering physics.

Professional degrees in engineering may be conferred on two classes of candidates: (1) those who have received an academic degree in engineering or in architecture from the University of Illinois; (2) those who have received an academic degree in engineering, including chemical engineering, from other institutions of equal standing and who have been members of the teaching or research staff of the College of Engineering or Engineering Experiment Station or the Departments of Chemistry or Architecture of the University of Illinois for at least three years prior to the conferring of the professional degree.

A candidate declares his candidacy by filing with the Dean of the College of Engineering, as chairman of the committee in charge, a detailed statement covering his professional engineering experience. This statement must be made upon a standard form supplied by the Dean of the College of Engineering, and must be filed not later than the first Monday in November preceding the Commencement at which the candidate expects to receive the degree. No statement of experience will be considered by the committee which does not show that the candidate has had a minimum of eight years of acceptable engineering experience after receiving the degree of Bachelor of Science, and that for at least five years he has been in responsible charge of engineering work. Responsible charge in engineering teaching may be considered as responsible charge of work. In determining the acceptability of the engineering experience of the candidate the committee will be guided by the character of his professional work and the degree of responsibility involved, and will take into consideration such evidences of professional ability and growth as may be shown by his investigation of engineering problems, his contributions to technical literature, and his membership and activity in engineering societies.

If the professional experience of the candidate is accepted he must submit for approval, prior to December 31, an outline of his proposed thesis. The completed thesis, in the form prescribed in the "Instructions for the Preparation of Masters' and Doctors' Theses," must be submitted to the Dean of the College of Engineering for approval not later than May 1. Major technical reports or plans and specifications for major engineering projects conceived and designed or directed by the candidate may be submitted for approval in lieu of a thesis. The candidate must present himself at Commencement in order to receive the degree.

A candidate for a professional engineering degree must pay the tuition fee of $25 on being notified that his professional experience is accepted as qualifying him to enter as a candidate for the degree. No one will be enrolled as a candidate for the degree at the following Commencement who does not pay his fee at this time. When a candidate for a professional engineering degree has once been accepted and paid his fee, he is eligible to receive the degree at any time within five years, without additional fee, on completion of the requirements; provided, however, that unless he completes the requirements within two years his name will be dropped from the list of candidates and in order to receive the degree within the five-year period he must register once more.

Professional Degrees in Education

Two professional degrees in education are offered: Master of Education (Ed.M.) and Doctor of Education (Ed.D.). The number of students who will be admitted to study for these degrees will be limited.

Degree of Master of Education. — This degree is designed for teachers, supervisors, administrative officers, and others engaged in educational work demanding broad, fundamental, and practical preparation and the ability to utilize professionally the contributions of research and of philosophy.

A minimum of two years of approved professional experience and the completion of the requirements for the degree of Master of Arts or Master of Science, or the equivalent, are required for admission to the curriculum leading to the degree of Master of Education. In addition, the candidate must be recommended by the college committee on admissions and guidance as showing promise of superior professional competence. In case the first year of graduate study does not include a major in education, the candidate will be required to take additional courses in education. The student's general education will also be reviewed, and appropriate courses may be required to correct any deficiencies.

A minimum of one year of graduate study (8 units) in addition to the requirements stated above will be required for the Ed.M. degree. This year of graduate study will be planned as a whole in consultation with the student's advisory committee. In addition to meeting other requirements, the candidate must pass a final examination administered by a college committee of a least three members.

Degree of Doctor of Education. — The purpose of the Doctor of Education (Ed.D.) degree is to continue the type of preparation indicated for the Master of Education (Ed.M.) degree and, in addition, to develop in the candidate further ability for scholarly study of professional problems. A candidate for the degree of Doctor of Education must have completed the requirements for the degree of Master of Education, or the equivalent. Toward the end of his second year or, by special permission, at the beginning of his third year of graduate study, a student who wishes to become a candidate for the degree of Doctor of Education must submit to preliminary examinations conducted by a committee appointed by the Dean of the Graduate School. The graduate faculty will advise a student not to attempt these examinations if the evidence does not indicate promise of outstanding professional competence.

The candidate, having completed the requirements for the degree of Master of Education, or the equivalent, and having passed the required preliminary examinations, must satisfy the residence requirements for the degree as stated below and must conduct a field study or other type of professional investigation, the report of which will constitute the thesis for the degree. This study will consist of a scholarly investigation of a significant professional problem.

The topic of the study, selected in consultation with the student's advisory committee, must be announced before the third year of graduate residence may begin. The study must have the approval of the graduate faculty of the College of Education and of the Executive Faculty of the Graduate School.

In a typical case, the candidate who is employed in professional work during the school year will devote a minimum of three summer sessions and two academic years to the field study or the professional investigation. The candidate will begin the first academic year of his study immediately after the completion of the first summer session. He will register during both semesters in a special

seminar for candidates for the degree of Doctor of Education. This seminar will require a minimum of three days each semester at the University. The candidate will be expected to demonstrate continued progress in the organization, planning, and execution of the study.

For the second year of the study the requirements will be similar to those of the first year and will include resident study during the summer session, devoted primarily to reading directed by the candidate's adviser, and followed by work in the field during the succeeding academic year. The third summer session in residence will be devoted primarily to the completion of the written report of the study which shall constitute the thesis for the degree of Doctor of Education.

Candidates for the degree of Doctor of Education who already hold the degree of Ph.D. from a recognized university will be regarded as special cases. They will be required to take the prescribed seminars and such other courses as the advisory committee may require. They will also take the preliminary examinations and conduct a field study or other type of professional investigation.

At least two weeks before the time when the degree is to be conferred, the candidate must submit to a final examination given by a committee appointed by the Dean of the Graduate School. This examination will deal primarily with the report of the thesis study, but will not be confined to that. It will be so conducted as to determine whether the candidate has a thorough and mature understanding of the field of education as a whole. The student may, in addition, be required to take any other examination, oral or written, that is thought proper by the various departments in which he has studied. The final examination may not be divided, but must be taken all at one time, even though this may require several sessions.

Two typewritten copies of the complete thesis in final form, the original on thesis paper and the first carbon on plain paper of approximately the same weight, must be deposited in the office of the Dean of the Graduate School for presentation to the examining committee not later than two weeks prior to the final examination and not less than four weeks before the time when the degree is to be conferred. With respect to form and to all other requirements, the regulations of the Graduate School covering theses for the Ph.D. degree will apply also to the report of the study for the Ed.D. degree.

Degree of Doctor of Philosophy

Major and Minor Subjects. — A student in the Graduate School who desires to become a candidate for the degree of Doctor of Philosophy is required to pursue a major subject in the department in which his research lies. He is also required to choose one minor subject, or he may choose two. If one minor only is chosen it must be taken in a department of study other than that of the major, and credit for it may be earned by work representing not less than four units, or one-sixth of the total residence required for the doctorate. If two minors are chosen, one must be a subject closely related to the major. With the approval of the adviser and the Dean it may be a division of the major field of study. The other minor (not less than two units) must, in that case, be taken in a department of study other than that of the major.

Except by special permission of the Dean the preliminary examination in major and minor subjects may not be taken until the minor work has been done.

Method of Computing Residence. — Credit for a full year of graduate work means that the student has during that time devoted all his working time and energy to study of a graduate grade. Second-year and third-year students shall register in terms of units. For each course with fixed credit or with variable credit within fixed limits, the registration shall be for such credit as is determined in the usual way for such courses. For thesis courses the amount of credit may be widely variable and may be fixed in each case in accordance with the judgment of the department and the needs of the student, subject to approval of the Dean of the Graduate School and the following provision regarding total credits: The registration for a full-time student shall be for not less than four nor more than five units; for a part-time student the registration shall ordinarily be on the basis of such fraction of four units as corresponds to the time given to study. It should be clearly understood, however, that, for second-year students, a mere accumulation of unit credits will not in itself entitle a student to the privilege of taking preliminary examinations, and that, for third-year students, such an accumulation of credits will not in itself entitle the student to admission to the final examination.

Period of Study. — The normal *minimum* period of study required for securing the degree of Doctor of Philosophy is three years, during which the student is required to devote all his working time to his studies. All three years must be spent in resident graduate study at some accredited educational institution and either the first two or the last one of the three must be spent at the University of Illinois. The degree is conferred, however, not for residence during a certain period, but for scholarly attainments and power of investigation, as proved by a thesis and examinations. For study in summer sessions, see page 11.

Work Done in Other Universities. — Credit for graduate work done in other universities is not "transferred." However, it may be accepted on examination as equivalent to resident work at the University of Illinois, provided the institution in which it was done is of high standing.

Preliminary Examinations. —

A. In Languages. — The student will be required to demonstrate his ability to read French and German and other languages needed in his work. (In special cases the Executive Faculty, upon recommendation of the student's adviser, may substitute for either one of the languages usually required some other language which can be shown to be more useful in that student's professional research.) No student will be considered as beginning his second year of residence for graduate credit until he has passed the examination in at least one of these languages. Both the examination in French and that in German must be passed before the student is admitted to the preliminary examination in his major and minor subjects. For the dates of these language examinations consult the calendar at the beginning of this bulletin, which also shows the dates when application for admission to these examinations must be made.

B. In Major and Minors. — Towards the end of his second year of study, or by special permission, at the beginning of his third year (not later than about November 1), a student who wishes to become a candidate for the degree must submit to a preliminary examination conducted by a committee appointed by the Dean. This examination is intended to test the student's knowledge of the fields of his major and minor subjects of study and to determine whether he is pre-

pared for the final year of work for the doctorate. It is partly oral, and may be wholly so.

The student will not be admitted to his preliminary examination until the faculty is satisfied that he has finished substantially the equivalent of two years' graduate work. He must do a full year's graduate work between his preliminary examination and the completion of his work for the doctorate.

Final Examination. — At least two weeks before the time when the degree is conferred, the candidate must submit to a final examination, given by a committee appointed by the Dean. This examination is primarily on the research work of the student, as embodied in his thesis, but it is not confined to that. It extends to the whole field of study of the candidate. It will not be confined to the courses which the candidate has attended in the University of Illinois only, if he has done part of the work elsewhere; nor even to the field covered by the courses specifically taken in this or other universities; but will be so conducted as to determine whether the candidate has a satisfactory grasp of his major subject as a whole, and a general acquaintance with the fields of knowledge represented by his course of study.

The final examination may not be divided. The examination must be taken all at one time even though it requires several sessions.

If after having passed his preliminary examination, he fails in the third year of his study to meet the expectations of the professors in charge of his work, or in any way fails to maintain the standard of scholarship and power of research expected of him, he may be refused admission to the final examination.

Other Examinations. — Before the candidate is admitted to the final examination and the defense of his thesis, he may be required to take any other examination, oral or written, that is thought proper by the various departments in which he has studied. Such examinations are in addition to those regularly scheduled in the courses for which the student is registeded.

Thesis. — The power of independent research must be shown by the production of a thesis on some topic connected with the major subject of study. The candidate is expected to defend his thesis or dissertation before the members of the faculty, or as many of them as may wish to question him about it, in connection with his final examination.

The subject of the thesis should be chosen not later than the end of the second year of residence and must be submitted for formal approval by the faculty not later than six weeks after the beginning of the third year of residence.

Two typewritten copies of the complete thesis, *the original on thesis paper* (no other will be accepted by the Dean), and the first carbon on plain paper of approximately the same weight, and in final form, must be deposited in the office of the Dean for presentation to the examining committee not later than two weeks prior to the final examination and not less than four weeks before the time when the degree is conferred. At the same time, the candidate must deposit with the Dean a manuscript of the essential part, or an abstract, or a digest of his thesis, in condition for publication at a cost not to exceed seventy-five dollars ($75). The manuscript must be sufficient to show the method followed, the evidence used, and the conclusions reached in the investigation, and must bear the approval of the department and the Executive Faculty of the Graduate School.

The candidate must pay to the Comptroller before graduation the sum of seventy-five dollars ($75) out of which the University will print at least one

hundred copies of this manuscript for circulation by the University, unless the thesis entire or in abbreviated form is published by the author or is accepted for publication by a standard journal or publisher within a year from the date of graduation. In the latter event, and after one hundred copies have been presented to the University by the writer, the cash deposit shall be returned to him.

The typewritten and printed forms of the thesis must comply with the regulations given in "Instructions for the Preparation of Masters' and Doctors' Theses," copies of which may be obtained at the Dean's office.

Degree of Doctor of Philosophy in Engineering

The degree of Doctor of Philosophy in Engineering is offered in certain lines of academic work of a high scholastic type in engineering science for students who wish to prepare themselves as teachers, investigators, and experts. The general requirements for this degree, as to preliminary education, linguistic attainments, etc., are the same as in other subjects.

The following lines of engineering science, or others approved by the Graduate School, may be elected as majors: ceramic engineering; chemical engineering; coal-mining engineering; electrical engineering; heating and ventilation engineering; hydraulic and sanitary engineering; masonry construction and structural engineering; mechanical engineering; steam engineering; theoretical and applied mechanics, including fluid mechanics and engineering materials.

The first minor may be in any of the above lines, or it may be one of the following sciences or an authorized combination of two of them: bacteriology; botany; chemistry; economics; geology; mathematics; physics (experimental or mathematical); thermodynamics; zoology.

The second minor should be in other than engineering subjects.

Agricultural and Engineering Experiment Stations

Attention is called to the unusual opportunities for graduate study in connection with the Agricultural and Engineering Experiment Stations. By undertaking a line of graduate study in close association with some one of the projects carried on in those Stations, the student will come into contact with aspects of his specialty which he would rarely touch in a purely academic study, and he will thus broaden his outlook. The experiment stations make available apparatus, equipment, and the services of mechanicians, which may materially facilitate the carrying on of investigations.

Scholarships, Fellowships, and Assistantships

A number of scholarships and fellowships have been established by the Trustees of the University open to candidates who are not over thirty years of age at the time when the appointment is to be made. To first-year graduate students of ability and promise there are open a number of scholarships carrying stipends of $500 and exemption from the payment of the usual tuition. Fellowships open to second-year and third-year graduate students carry stipends of $750 and $900, respectively, and exemption from tuition. To be eligible for a $900 fellowship, an applicant must pass his language examinations before the date for filing applications and must be prepared to take the preliminary examination in his major and minor subjects by the following June.

Candidates for these scholarships and fellowships must be graduates of the University of Illinois, or of colleges or universities having equivalent requirements for bachelors' degrees.

Application must be made on blanks to be obtained from the Dean of the Graduate School. These application forms should be sent to the Dean of the Graduate School as early as possible in February of the academic year preceding that for which the fellowship is desired. No application will be considered if received later than February fifteenth, until after April fifteenth, the date when appointees from the first list of applications must accept or refuse their appointments.

Persons appointed are notified on April first and must send the Secretary of the Board of Trustees notice of their acceptance or refusal by April fifteenth; and must agree that, if accepted, the appointment will not be resigned to take a similar one in any other institution during the year for which it is awarded, and that they will not engage in any outside employment for remuneration.

Nominations to fellowships are made on the grounds of worthiness of character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself.

Andersen Scholarship in Accountancy. — One scholarship is offered annually by Arthur Andersen, C.P.A., through the Arthur Andersen Research and Educational Fund, to a first-year graduate student in accountancy. It is awarded, with a stipend of $500, on recommendation of a committee of the College of Commerce and Business Administration selected for that purpose.

Carr Fellowship in Chemistry. — The Honorable Robert F. Carr, of the Class of 1893, gave in 1919 the sum of ten thousand dollars, the income of which is to be used as the stipendium of a fellowship in chemistry or chemical engineering.

Sahara Scholarships and Fellowships in Mining Engineering. — A number of graduate scholarships and fellowships in mining engineering have been established by the Sahara Coal Company. One or more are awarded each year, with a stipend of $700, on recommendation of the Department of Mining and Metallurgical Engineering. They are for one to three years of graduate study and research in coal-mining engineering.

Sharp Scholarship in Library Science. — The Katharine L. Sharp scholarship was endowed in 1933 by the University of Illinois Library School Association as a memorial to the founder of the Library School. It is awarded, with a stipend of $300 and exemption from tuition, on recommendation of the Library School faculty.

Research Graduate Assistantships in the Engineering Experiment Station. — The Engineering Experiment Station is devoted to the study of problems of special importance to engineering and to manufacturing, railway, mining, and industrial interests, and the stimulation and elevation of engineering education. Approximately fourteen research graduate assistantships with a nominal stipend have been established, open to graduates of approved technical schools and universities. Applicants to whom these graduate assistantships are awarded agree to hold them for two years, devoting one-half their time to the work of the Engineering Experiment Station. At the end of this period, if all requirements have been met, the degree of Master of Science will be conferred. Several additional assistantships are usually maintained by industrial organizations. Applications for graduate assistantships should be made to the Director of the Engineering Experiment Station not later than March 1.

Assistantships. — Applications for assistantships should be made to the head of the department in which the assistantship is desired.

Libraries

The general University library, including the departmental libraries listed below, is located at the University in Urbana. The Quine Library of Medical Sciences is in Chicago.

These libraries contain about 2,076,200 cataloged volumes; there are also more than 13,800 cataloged maps, 17,000 music scores and parts, 459 manuscripts, and over 434,000 partly cataloged and roughly classified pamphlets available for use. Of these, 1,982,094 cataloged volumes and 424,338 partly cataloged pamphlets are in Urbana. Over 16,400 periodicals and newspapers are currently received.

The main Library Building is open from 8 a.m. to 10 p.m. Monday through Friday, and from 8 a.m. to 6 p.m. Saturday.

In the book stacks are 216 cubicles for the use of faculty members and graduate students.

A number of departmental and college libraries are maintained in the library and in other buildings on the campus; these libraries include only part of the research materials in their respective fields. Additional material is available in the stacks. In some instances they are primarily for the use of the graduate students and advanced undergraduate students in the departments using the respective buildings. The principal departmental libraries are the following:

Name of Library	*Location*	*Volumes*
Classics	Library Building	33,600
Commerce, Sociology, and Social Welfare Administration	Library Building	8,000
English	Library Building	9,000
History and Political Science	Library Building	18,100
Germanic and Romance Languages	Library Building	8,100
Philosophy, Psychology, and Education	Library Building	10,200
Rare Book Room	Library Building	31,500
Agriculture	Mumford Hall	31,000
Architecture, Ricker Library of	Architecture Building	20,800
Chemistry	Noyes Chemistry Laboratory	22,900
Engineering	Engineering Hall	52,700
Journalism	Gregory Hall	4,400
Landscape Architecture	Mumford Hall	8,100
Law	Altgeld Hall	80,800
Mathematics	Mathematics Building	14,000
Music	Smith Music Hall	9,000
Natural History	Natural History Building	64,100
Physics	Physics Building	4,600

The library includes most of the bibliographical aids published for the book-trade in this and other countries; a Union Card Catalog numbering in excess of 3,000,000 cards, chiefly of books in ten other large American libraries; many printed catalogs of important libraries, e.g., Catalogue of Printed Books in the British Museum, Gesamtkatalog der Preussischen Bibliotheken, and Catalogue Général des livres imprimés de la Bibliothèque Nationale; and many bibliographies of special subjects.

The following brief statements indicate the resources of the library for research in a few subjects selected at random:

Official publications of municipalities number about 45,000 reports, charters, and ordinances, issued by over 3,000 American and 325 foreign municipalities, and more or less complete files of about 50 municipal periodicals. Systematic attempts are made to secure current publications, especially of Illinois municipalities.

Italian history includes the Cavagna Library. 40,000 volumes, pamphlets, and maps, and 138 bundles of manuscripts with typed partial index to families and places dealt with; much material of Italian local history, biography, and genealogy.

Classical literature, history, and archaeology embrace approximately 33,600 volumes including complete sets of about 150 journals and serials; the library of Professor Wilhelm Dittenberger, of Halle, 5,600 items; the library of Professor Johannes Vahlen, of Berlin, 10,000 items; and a collection of about 17,000 dissertations, reprints, etc.

The Ricker Library of Architecture numbers 20,800 volumes, 18,300 lantern slides, and 21,600 photographs and drawings. It is not only a good working library for faculty and students in architecture, but also contains many of the older and rarer works.

The Rare Book Room houses about 31,500 volumes, including the Milton collection of approximately 2,500 volumes, and other titles relating to the literary, political, and religious life of seventeenth century England, especially the Milton period.

The newspaper collection contains about 24,000 bound volumes of general newspapers. Included in it are files of 270 newspapers published in Illinois, generally complete since 1912, and 315 foreign language newspapers published in this country, generally complete since 1917. In the latter group are newspapers in 33 different languages. Thirty general metropolitan dailies from states other than Illinois are currently received and preserved.

Fees and Expenses

Tuition Fee.—

Residents of Illinois, except those holding scholarships and fellowships, pay each semester a tuition fee of $40.00

Non-residents of Illinois, except those holding scholarships and fellowships, pay each semester a tuition fee of 80.00

Residents of Illinois registered for only two units of credit or less a semester, pay for each unit 12.00

Non-residents of Illinois registered for only two units of credit or less a semester, pay for each unit 24.00

Students enrolled for thesis work for the master's degree on leave of absence pay a tuition fee of 20.00

Candidates for professional degrees in engineering pay each year a tuition fee of 25.00

For exemption from fees, see page 24.

Hospital and Medical Service Fee.[1]—All students registering for resident work, except those who are on University appointment other than fellows and scholars or on appointment in allied surveys and laboratories on the Urbana campus, and those who are registered for not more than one unit of graduate work, pay each semester a hospital and medical service fee of 5.00

Laboratory, Library, and Supply Fee.—Students taking more than two units of instruction pay each semester a laboratory, library, and supply fee of 8.00

(Students taking two units or less pay $4 each semester.)

[1] A student who presents evidence of participation in any other group insurance system providing the same benefits as those covered by the University fee, may petition through the office of the Dean of Students for a refund of this fee.

Illini Union Service Charge. — All students registering for resident work, except those who are members of the University staff and others who are registered for not more than one unit of graduate work, are assessed each semester an Illini Union service charge of..... 5.00

Late Registration Fee. — Former students who register after the regular registration days in either semester pay a late registration fee of..... 5.00

Change of Study-list Fee. — For every change slip issued later than noon on Monday of the fourth week following the regular registration date, the fee is..... 1.00

Transcript Fee. — Each student who has paid all his University fees is entitled to receive, without charge, one transcript of his record. For each additional transcript the fee is..... .50

General Deposit. — Each student, except persons on appointment as members of the staff of the University or of allied surveys and laboratories, makes a deposit of $5 at the time of his first registration. Chargeable against this deposit are such items as library fines for books lost or not returned when due, unreturned towels and locks, shortages in laboratory equipment and other supplies loaned to students. Whenever the balance in a student's deposit account falls below $2.50, he is required to make an additional deposit to bring it up to $5. Whatever balance there is to his credit will be returned to him after he completes the requirements for a degree or officially withdraws from the University.

Service Charge for Deferred Fees. — A service charge of ten per cent of the amount of fees deferred, but not to exceed $3 a semester, is assessed for the privilege of deferring fees. If deferred fees are paid in full within ten days after registration, the service charge is refunded except that a minimum service charge of $1 is retained by the University in all cases. The general deposit of $5 (if this deposit has not been made earlier), the service charge for deferring fees, and all charges from previous semesters must be paid on the day of registration.

Exemption from Fees. — Persons on the academic and administrative staffs of the University in any capacity, or who are on scholarship or fellowship appointment in the Graduate School, or who are on permanent employment on the nonacademic staff, or who are on appointment in the allied surveys and laboratories on the University campus, may register in University courses for which they are eligible for admission without payment of the tuition fee and the laboratory, library, and supply fee, provided their annual salary is $2,400 a year or less. (Nonacademic employees must secure the approval of the head of their department or division.)

Permanent nonacademic employees without regard to salary may register without payment of any fees or deposits under the following conditions: (1) In any regular University course in which the employee is requested by the Department, with the concurrence of the Director of Nonacademic Personnel, to enroll for the improvement of the employee's present work. (2) Any special course looking toward improving University service organized at the request of the Director of Nonacademic Personnel in cooperation with the teaching staff, the employee concerned, and the department in which such employee is located.

Expenses. — Although personal expenses may vary a great deal, the following estimates indicate the average cost for students: board, $10 to $12 a week; room rent, single rooms range from $16 to $25 a month and double rooms from $15 to $20 a month for each person.

DEPARTMENTS OF INSTRUCTION

Courses open to graduate students are of two classes. The first class is wholly of graduate grade, and the courses are numbered 100 upwards. The second class includes the courses classified as for graduates and advanced undergraduates. These carry numbers below 100. The courses numbered 100 and upwards are all accepted for major credit. Those of the other group are in many cases accepted for minor credit only. This is especially true of courses which are open to juniors.

All courses have certain prerequisites for admission. Inasmuch as the prerequisite preparation may be gained at other institutions from courses differing from those offering a similar preparation at the University of Illinois, so that a statement of prerequisites as given here would not be understood elsewhere, their description is omitted altogether. However, a student who wishes to enter a particular course must satisfy the department concerned that he has had in some form the prerequisites for admission to the course.

For the convenience of students the credit value of graduate courses is given in units. The credit received for "courses for graduates and advanced undergraduates" is in accordance with the regulations of the Graduate School (see page 10).

AGRICULTURAL ECONOMICS

Graduate students may take work in agricultural economics leading to the degrees of Master of Science and Doctor of Philosophy. Work is offered in marketing, prices, statistics, economic policies, and finance as applied to agriculture; farm management; land economics; international comparative agriculture; and rural sociology.

Students who desire to secure degrees in agricultural economics are required to have completed either (1) a course of study equivalent to that required for the degree of Bachelor of Science in Agriculture at the University of Illinois, and including twelve hours of agricultural economics and economics; or (2) twelve hours of undergraduate economics and agricultural economics, and in addition at least eight hours in accountancy, business organization and operation, history, political science, and sociology.

A candidate for the degree of Master of Science is required to register for at least two units in economics, including one unit of economic theory. For the degree of Doctor of Philosophy he is required to register for at least five units in economics, including economic theory and history of economic thought.

If approved by the Department of Agricultural Economics and the Dean of the Graduate School, the required work in economics may be treated as a part of the major field. Otherwise, the work in economics will be considered a first minor, in which case the program in that minor will require the approval of the Department of Economics. (See requirements in economics for a minor in that field.)

To take agricultural economics as a minor the student must have had at least twenty hours of undergraduate work in economic and agricultural subjects.

Courses for Graduates

109. Seminar. Thesis Course.—All graduate students whose major is agricultural economics must register in this course, but only those writing theses acceptable for the degrees of Master of Science or Doctor of Philosophy will be given credit. Once a week; both semesters. *One to four units.* Professor Case and senior members of the department.
110. International Comparative Agriculture.—Once a week; first semester. *One unit.* Professor Stewart.
111a. Agricultural Prices and Statistics.—Twice a week; first semester. *One unit.* Professor Working.
111b. Agricultural Prices and Statistics.—Twice a week; second semester. *One unit. Prerequisite:* Agricultural Economics 111a or its equivalent. Professor Jordan.
112. Agricultural Economics Research.—Credit is conditional upon the completion of an acceptable report of investigation. Once a week; both semesters. *One to two units.* Members of the department.
118. Land Economics.—Twice a week; second semester. *One unit.* Professor Stewart.
119. Economic Policies and Programs Affecting Agriculture.—Twice a week; first semester. *One unit.* Professor Norton and others.
120a. Farm Management Principles and Investigational Methods.—Three times a week; first semester. *One unit.* Professor Johnston.
120b. Farm Management Principles and Investigational Methods.—Twice a week; second semester. *One unit. Prerequisite:* Agricultural Economics 120a or 25 or equivalent. Professor Johnston.
135. Problems in Marketing Agricultural Products.—Twice a week; second semester. *One unit.* Professors Norton, Ashby, Bartlett.
140. Seminar in Rural Sociology.—Once a week; second semester. *One unit.* Professor Lindstrom.

Courses for Graduates and Advanced Undergraduates

6. Agricultural Statistics.—Three times a week; first semester. Professor Working.
7. Rural Sociology.—Same as Sociology 7. Three times a week; second semester. Professor Lindstrom.
8. Agricultural Prices.—Three times a week; second semester. Professor Jordan.
10. Economic Relationships of Agriculture.—Three times a week; first semester. Professor Stewart.
14. Management Problems of Farmers' Cooperatives.—Twice a week; second semester. Professor Norton.
15. Financing Agriculture.—Three times a week; second semester. Professor Norton.
18. Land Economics.—Three times a week; second semester. Professor Stewart.
22. Types and Systems of Farming.—Field trip required; estimated expense, $3. Three times a week; first semester. (Not given in 1947-1948.) Associate Professor Wilcox.
24. Farm Operation.—Three times a week; second semester. Associate Professor Wills.
25. Advanced Farm Management.—Field trip required; estimated expense, $5. Three times a week; first semester. Professor Johnston.
26. Agricultural Law.—Three times a week; first semester. Associate Professor Hannah.
31. Grain Grading and Marketing.—Same as Agronomy 14. Twice a week; first semester. Professor Norton.
34. Marketing Dairy Products.—Inspection trip required; estimated expense, $5. Twice a week; second semester. Professor Bartlett.
36. Marketing Horticultural Products.—For seniors and graduates specializing in horticulture. Three times a week; first semester. Assistant Professor Kelly.

37. Marketing Livestock.—Twice a week; second semester. Professor Ashby.
42. Farm Appraisals.—Same as Agronomy 35. Local field trips to be arranged; estimated expense, $5. Four times a week; second semester. Members of departments involved.

AGRICULTURAL ENGINEERING

The Department of Agricultural Engineering offers a minor for students interested in graduate work in agricultural engineering. The master's degree can be secured by selecting a major in a department of the College of Engineering and a second minor in a related field.

Courses for Graduates and Advanced Undergraduates

24. Farm Home Planning in Relation to Function.—Same as Home Economics 24. A study of housing as affected by modern trends in family life and details involved in planning a functional house. Three times a week; second semester. Professor Carter.
42. Hydraulics of Soil and Water Conservation.—Watersheds, run-off studies, cross sections of gullies; capacities of structures, terraces, and terrace outlets; design of structures; constructing terraces; machines used in erosion control; estimating costs and benefits of various methods of control. Three times a week; first semester. Associate Professor Hay.
43. Farm Power.—History, development, transmission, measurement, efficiency, design, principles of operation, sources, adaptation. Three times a week; first semester. Mr. Ramser.
44. Design of Agricultural Machinery.—Survey of needs and requirements, layout of design, estimation of cost, and study of production problems. Twice a week; second semester. Mr. Ramser.
45. Advanced Farm Structures.—Materials, construction, planning, and design of shelter, storage, and residence buildings. Three times a week; first semester. Professor Carter.
51. Special Problems in Agricultural Engineering.—Each student chooses a special problem for design, laboratory, or field work with special library research. Both semesters. Work may be taken in two of the following fields:
    (a) Drainage and Soil Erosion Control.—Associate Professor Hay.
    (b) Farm Buildings.—Professor Carter.
    (c) Farm Power.—Professor Shawl.
    (d) Farm Machinery.—Professor Shawl.
    (e) Rural Electrification.—Professor Lehmann.

AGRICULTURE

Candidates for the degree of Master of Science in Vocational Agriculture must earn four units in agriculture, two units in education, and two units in electives. Requirements are agriculture, 4 units; Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The courses in agriculture and the electives must be selected with the approval of the adviser. The electives may be in agriculture, in education, or, in exceptional cases, in other fields.

AGRONOMY

Candidates for the Master of Science and Doctor of Philosophy degrees in Agronomy may specialize in soil fertility, soil physics, soil biology, plant breeding, or crop production. For either degree, if two minors are chosen, the first should be, and both may be, taken in a department other than agronomy. If only one minor is chosen, it must be in some other department.

A candidate for the master's degree in agronomy must present an acceptable thesis, unless thesis requirement is waived, and show proficiency in his work as demonstrated by suitable examinations, prescribed by the department.

Students must have had the fundamental work in science prerequisite to the major and minor fields of study. Fifteen semester hours in agronomy and related subjects are prerequisite for a minor, and five additional hours for a major; but students with unusually good training in science may be exempted from certain of these requirements.

Courses for Graduates

101. Chemical Properties of Soils; Their Relation to Soil Development and Plant Growth.—Twice a week; first semester. *One unit.* Professor DeTurk.
104. Seminar.—Once a week; both semesters. *One-fourth unit.* The graduate staff.
108. Pasture, Range, and Soil Conservation Research.—Once a week; second semester. *One unit.* Associate Professor Fuelleman.
112. Theory and Analysis of Plant Breeding Problems.—Three times a week; second semester. *One unit.* Professor Woodworth.
114. Principles Underlying the Production of Crops.—Twice a week; second semester. *One unit.* Professors Burlison, Dungan.
118. Research.—A special problem is chosen by each student. Graduate students writing theses should so indicate in registering in Agronomy 118. Both semesters. *One-half to four units.*
   (a) Soils.—Professors Bauer, DeTurk, R. S. Smith, Sears, Bray, Gieseking, Assistant Professor Stauffer.
   (b) Crops.—Professors Burlison, Woodworth, Dungan, Koehler, Bonnett, Jugenheimer, Associate Professor Fuelleman.

Courses for Graduates and Advanced Undergraduates

7. Crop Production as Affected by Environmental Factors.—Three times a week; first semester. Professor Dungan.
8. Forage Crops.—Three times a week; second semester. Associate Professor Fuelleman.
10. Genesis, Morphology, Classification, and Geography of Soils.—Local field trips to be arranged; estimated expense, $16. Three times a week; second semester. Assistant Professor Whiteside.
11. Role of Microorganisms in Soil Fertility.—Three times a week; first semester. Professor Sears.
13. Soil Productivity, Its Variation, Modification, and Conservation.—Three times a week; second semester. Professor Bauer.
14. Grain Grading and Marketing.—Same as Agricultural Economics 31. Twice a week; first semester. Professor Dungan.
22. Improvement of Farm Crops by Breeding.—Three times a week; first semester. Professor Bonnett.
29. Principles of Field Plot Experimentation.—Three times a week; first semester. Professor Woodworth.
30. Metabolism of Soil Microorganisms.—Three times a week; second semester. Professor Sears.

32. Physical Methods for Soil Conservation Studies.—Three times a week; first semester. (Given in alternate years; not given in 1947-1948.) Assistant Professor Stauffer.
33. Chemistry of Fertilizers and Their Soil Reactions.—Three times a week; first semester. Professor Bray, Associate Professor Kurtz.
35. Farm Appraisals.—See Agricultural Economics 42.
36. Corn Breeding.—Three times a week; second semester. Professor Jugenheimer.

ANIMAL SCIENCE

(Including Animal Nutrition)

The Department of Animal Science offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy in Animal Science and in Animal Nutrition. For a major or minor for the master's degree the student may specialize in the general field of animal production, or in the special fields of animal genetics, animal nutrition, poultry husbandry, and meats. For a major or minor for the doctor's degree he may specialize in animal genetics, the economics of meat production, and animal nutrition. Advanced work in poultry husbandry may be taken for a minor for the doctor's degree.

Animal Science. — For registration for a minor in animal science for either the master's or the doctor's degree, a student must offer at least fifteen college credits in the field, including the principles of feeding, the principles of genetics, livestock production, and livestock judging, and he must have had an introductory course in organic chemistry. For a major a student must offer at least five additional college credits in animal science or in courses related to the major field of specialization. To qualify for graduate study in the field of meats, a student must offer credit in Animal Science 10, 24, and 36, or equivalents. Besides these general requirements, a student must have had the special training required for effective graduate study in the field of his chosen major: for work in animal production, the economics of meat production; for work in poultry husbandry, an introductory course in farm management; for work in animal genetics, at least an introductory course in general zoology; for work in meats, those basic sciences, such as chemistry, physics, histology, or other field, within which his chosen problem for graduate study lies.

Students who desire to take a minor for the doctor's degree in the general fields of animal production or the economics of meat production must take Animal Science 41 and Animal Nutrition 101 if they have not taken these courses or their equivalents during their undergraduate training. Such students registering for a major in these general fields must take in addition Animal Nutrition 102, and will find it desirable to register in Veterinary Pathology and Hygiene 5.

In the case of students with an unusually thorough training in science who wish to pursue graduate work in some special field of animal science from a non-agricultural viewpoint, the department may waive certain of the above requirements.

Animal Nutrition. — For registration for a major or minor in animal nutrition for either the master's or the doctor's degree, a student must have had adequate training in chemistry, including quantitative analysis and organic chemistry, and preferably also courses in physiology and bacteriology. For registration for a second minor for the master's degree a course in quantitative analysis need not be offered.

Note.—Attention is also directed to the advisability of including in undergraduate preparation for graduate work in any phase of animal science or in animal nutrition at least introductory training in French or German and in mathematics, including, or prerequisite to, statistics.

ANIMAL SCIENCE

Courses for Graduates

100. Animal Science Seminar.—Once a week; both semesters. *One-half unit.* Members of the graduate staff.
112. Research.—One to three times a week; both semesters. *One-half to two units.* Work may be taken in the following:
   (a) Economic Factors in Meat Production.—Professors Rusk, Carroll, Kammlade, Bull, Snapp, Krider.
   (b) Systems of Livestock Farming.—Professor Case.
   (e) Animal Genetics.—Professor Roberts, Associate Professor Nalbandov.
   (f) Poultry Husbandry.—Professors Card, Scott, Associate Professor Nalbandov.
   (g) Meats.—Professor Bull.
117. Advanced Animal Genetics.—Three times a week; first semester. *One unit.* Professor Roberts.
118. Physiology of Reproduction.—Three times a week; second semester. *One unit.* Associate Professor Nalbandov.
121a. Laboratory Methods in Animal Genetics.—Two to five times a week; both semesters. *One-half to one unit.* Professor Roberts.
121b. Laboratory Methods in Physiology of Reproduction.—Two to five times a week; both semesters. *One-half to one unit.* Total combined credit in Animal Science 121a and 121b may not exceed two units. Associate Professor Nalbandov.
125. Special Problems in Beef Production.—Three times a week; second semester. *One unit.* Professor Snapp.
126. Special Problems in Swine Research.—Twice a week; first semester. *One-half unit.* Professor Krider.
127. Problems in Sheep and Wool Production and Research.—Twice a week; second semester. *One-half unit.* Professor Kammlade.
137. Special Problems in Poultry Husbandry.—Twice a week; first semester. *One-half unit.* Professor Card.

Courses for Graduates and Advanced Undergraduates

25. Beef Production.—Three times a week; first semester. Professor Snapp, Assistant Professor Francis.
26. Pork Production.—Three times a week; both semesters. Professor Krider.
27. Sheep Husbandry.—Three times a week; second semester. Professor Kammlade.
37. Poultry Management.—Three times a week; second semester. Professor Scott, Associate Professor Nalbandov.
41. Animal Genetics.—Three times a week; second semester. Professor Roberts.

ANIMAL NUTRITION

The Division of Animal Nutrition offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy. To qualify for graduate study in this field, a student should have an adequate knowledge of organic chemistry and quantitative analysis, and preferably an introduction to physiology. It is advisable also to include in undergraduate preparation for graduate study in animal nutrition, at least introductory training in French or German and in mathematics.

Courses for Graduates

101. Principles of Animal Nutrition.—Physical and chemical properties of nutrients; digestion and metabolism; functions and utilization of nutrients; principles determining nutritive requirements of animals. Five times a week; first semester. *One unit.* Professor Hamilton.
102. Advanced Course in Animal Nutrition.—Five times a week; second semester. *One unit.* Professor Mitchell.
103. Laboratory Methods in Animal Nutrition.—Two to five times a week; both semesters. *One-half to one unit.* Professor Hamilton.
104. Methods of Vitamin Assay.—Two to five times a week; second semester. *One-half to one unit.* Associate Professor Johnson.
105. Animal Nutrition Seminar.—A review of current literature in the science of nutrition. Two hours a week; both semesters. *One-half unit.* Professor Mitchell.
106. Research.—One to five times a week; both semesters. *One-half to three units.* Professors Mitchell, Hamilton, Associate Professor Johnson.
107. Vitamins in Nutrition.—Nutritional requirements for individual vitamins; physiological function; metabolism and deficiency symptoms in different species. Four times a week; first semester. *One unit.* Associate Professor Johnson, Assistant Professor Spector.
108. Laboratory Methods in Vitamin Nutrition.—Feeding experiments designed to acquaint students with the symptoms of vitamin deficiency and with recent methods of research in vitamin nutrition. One to five times a week; both semesters. *One-fourth to one unit.* Associate Professor Johnson, Assistant Professor Spector.

Courses for Graduates and Advanced Undergraduates

51. An Introduction to Animal Nutrition.—For students whose major is in some other field than Animal Nutrition. Three times a week; second semester. Professor Hamilton.

ARCHITECTURE AND ARCHITECTURAL ENGINEERING

The prerequisite for graduate work in architecture is the equivalent of the undergraduate courses required for the bachelor's degree in the branches of the subjects in which registration is desired.

Courses for Graduates

101. Architectural Construction.—Special research. Twice a week; both semesters. *One-half to two units.* Professor Palmer.
103. Architectural Construction.—Theory and design. Twice a week; both semesters. *One-half to two units.* Professor Morgan.
104. Architectural Design.—Advanced course. Both semesters. *One to three units.* Professor Love.
106. Architectural History.—Special research. Twice a week; both semesters. *One-half to two units.* Professors Newcomb, Laing.

Courses for Graduates and Advanced Undergraduates

15. Architecture and Civilization of Medieval Europe, A.D. 1200 to 1500.—An analysis of structural space and medieval form in Europe. Twice a week; both semesters. Professor Laing.
16. Architecture and Civilization of Renaissance Europe, A.D. 1400 to 1800.—Continuation of Architecture 15. Twice a week; both semesters. Associate Professor O'Donnell.
17. Architecture and Civilization of the Americas to 1870.—Twice a week; both semesters. Associate Professor O'Donnell.

18. Architecture and Civilization of the Americas and Europe since 1870.—Twice a week; both semesters. Professor Laing.
35-36. Architectural Design.—Principles of site planning, group planning, and studies of other contemporary architectural problems. Four times a week; both semesters. Associate Professor Salogga.
37-38. Architectural Design.—Advanced study of community planning, with reference to modern complex building requirements. Five times a week; both semesters. Professor Love.
47. Theory of Structures.—Analysis of framework, churches, industrial buildings, arches; deflections; elastic theory. Five times a week; both semesters. Professor Morgan, Associate Professor Branch.
48. Advanced Structures.—Theaters, assembly halls, and high buildings; continuous beams and trusses; rigid frames; statical indetermination. Five times a week; both semesters. Professor Morgan.
57. Reinforced Concrete Theory.—Principles of reinforced concrete construction; theory of design of structural elements. Three times a week; both semesters. Professor Palmer.
58. Reinforced Concrete Design.—Reinforced concrete building design; analysis of various types of modern fireproof construction. Three times a week; both semesters. Professor Morgan.
68. Specifications.—Lectures and discussion of specifications for buildings; supplementary and general conditions of the contract; detailed specifications; supervision and superintendence; building laws and codes. Three times a week; both semesters. Professor Provine.
83. Architectural Practice.—From school to practice; discussion of professional ethics and problems confronting the architect in the conduct of his business; procedure and control of work in the office and in the field; methods of making architectural estimates; contracts and contract documents; awarding of contracts. Twice a week; both semesters. Professor Provine.

ART

The prerequisite for graduate work for the degree of Master of Fine Arts is the equivalent of the undergraduate courses required for the Bachelor of Fine Arts degree. In the event that a prospective candidate for the Master of Fine Arts degree is found to be deficient in any phase of his undergraduate training, the Departmental Graduate Committee may require the student to take such undergraduate courses as will remove such deficiency.

Degree of Master of Fine Arts in Painting. — In order to qualify for the Master of Fine Arts degree in Painting, each student is required to complete satisfactorily a minimum of eight units from the following courses: Art 101, 1 unit; Art 102, 1 to 2 units; Art 105, 2 to 4 units; Art 110, ½ to 2 units; and two courses in advanced Art History, 1½ units. A thesis must be submitted and approved.

Degree of Master of Fine Arts in Art History. — In order to qualify for the Master of Fine Arts degree in Art History, each student is required to complete satisfactorily a minimum of eight units from the following courses: Art 101, 1 unit; Art 102, 1 to 4 units; Art 110, ½ unit; Advanced Art History, 1½ to 3 units; elective, 1 to 2 units. A thesis must be submitted and approved.

Degree of Master of Fine Arts in Art Education. — Candidates for the degree of Master of Fine Arts in Art Education must earn four units in art, two of which are electives, three units in education, and one unit in an elective. Requirements are Advanced Art History, 1 unit; Art 101, 1 unit; Education 68, Curriculum Problems and Trends in Art Education, 1 unit; Education 101,

Philosophy of Education, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The elective courses in art and the other elective must be selected with the approval of the adviser. The elective may be in art, in education, or, in exceptional cases, in another field.

Courses for Graduates

101. SEMINAR.—The study of the relationship of theory to practice in the arts. Twice a week; both semesters. *One unit.* Professors ROOS, WELLER, Associate Professor DOOLITTLE.
102. SPECIAL PROBLEMS.—Thesis. Individual investigation in a selected field. Twice a week; both semesters. *One to two units.* Professors ROOS, WELLER, Associate Professor DOOLITTLE.
105. PAINTING LABORATORY.—Concentration may be made in one or more of the following areas: composition, portraiture, figure painting, landscape painting, mural painting. Twice a week; both semesters. *One to four units.* Professor ROOS, Associate Professor DOOLITTLE.
110. MATERIALS AND PROCESSES.—The study of materials and techniques in painting and the graphic arts. Twice a week; both semesters. *One-half to two units.*

Courses for Graduates and Advanced Undergraduates

13a. CLASSICAL ART.—Three times a week; first semester.
14a. MEDIEVAL ART.—Three times a week; second semester.
15a. ITALIAN RENAISSANCE ART.—Three times a week; both semesters.
15b. NORTHERN RENAISSANCE ART.—Three times a week; second semester.
16a. ART OF THE NINETEENTH CENTURY.—Three times a week; both semesters.
17a. ART OF THE TWENTIETH CENTURY.—Three times a week; both semesters.
18a. AMERICAN ART.—Three times a week; second semester.

ASTRONOMY

The prerequisites for graduate study in astronomy are mathematics through calculus, a year's course in descriptive astronomy, and a course in college physics.

Courses for Graduates

101. SEMINAR.—Three times a week; both semesters. *One unit.* Professor BAKER.

Courses for Graduates and Advanced Undergraduates

7. CELESTIAL MECHANICS.—Three times a week; second semester. Professor BAKER.
14. OBSERVATIONAL ASTRONOMY.—Three times a week; first semester. Professor BAKER.

BACTERIOLOGY

Students electing bacteriology as a major for an advanced degree must have had at least ten semester hours of bacteriology and fifteen semester hours of some other physical or biological science.

Bacteriology 8, 9, 26, 27, 103, and 107, or their equivalents, are required for a master's degree. Each candidate is required to pass a general written examination toward the close of the second semester of residence.

Candidates for a Doctor of Philosophy degree in bacteriology are required to have a general knowledge of bacteriology as applied to plant pathology, dairy

bacteriology, and soil biology; appropriate courses in these subjects will be counted toward the requirements for the degree. Those who select a first or second minor in bacteriology must offer at least three units for the first minor and two and one-half units for the second minor, exclusive of an introductory course (Bacteriology 20 or its equivalent), selected from the courses offered in this department or, for satisfactory reasons, from certain courses in the related subjects mentioned above, and must include Bacteriology 103 and one advanced laboratory course.

Attention is called to the following courses, some of which must be elected for advanced degrees in bacteriology: Agronomy 11, 30, 31; Botany 72, 79, 117, 171, 172; Chemistry, 29b, 50, 86a; Dairy Husbandry 10, 106, 112, 113; Horticulture 51, 151, 152; Veterinary Pathology and Hygiene 3, 101, 102, 103; Zoology 18, 30, 31, 118, 131.

Courses for Graduates

103. Physiology of Bacteria.—Twice a week; first semester. *One unit.* Professor Tanner.
107. Research.—For those who are taking a major in bacteriology either for the doctor's or master's degree. Both semesters. *One-half to four units.* Professor Tanner, Associate Professors Wallace, Clark.
118a-118b. Current Literature.—Required of all graduate students whose major is bacteriology. Once a week; both semesters. *One-fourth unit.* Professor Tanner.

Courses for Graduates and Advanced Undergraduates

8. Food and Applied Bacteriology.—Microbiology of foods; preservation technology, analysis; food poisoning and food-borne intoxications. Five times a week; second semester. Professor Tanner, Associate Professor Clark.
9. Bacterial Nutrition and Vitamin Assays.—Four times a week; first semester. Associate Professor Clark.
10. Epidemiology.—Twice a week; second semester. Associate Professor Wallace.
20. General Bacteriology.—Five times a week; both semesters. Associate Professors Wallace, Clark.
26. Pathogenic Bacteriology.—Five times a week; first semester. Associate Professor Wallace and assistant.
27. Immunology and Serology.—Five times a week; second semester. Associate Professor Wallace.

BIOLOGICAL SCIENCES

Through the Division of the Biological Sciences (including bacteriology, botany, entomology, physiology, psychology, zoology) it is possible to arrange a program leading to the Degree of Master of Science in the Biological Sciences, intended especially to serve the needs of teachers. While the main emphasis will be on botany and zoology, the candidate must have at least one unit in each of the following subjects: bacteriology, botany, entomology, physiology, and zoology. One unit in psychology (other than educational psychology) is strongly recommended. In planning his course of study the candidate should seek to attain the desired diversity by giving less emphasis to subjects in which he has already had considerable training; but at least one unit must be taken in courses of graduate grade (courses numbered 100 and upwards). No thesis is required, but at least one course should be included in which individual problems are assigned.

Candidates for the degree of Master of Science in the Teaching of the Biological Sciences and General Science must earn four units in biological sciences, two units in education, and two units in electives. Requirements are biological sciences, 4 units; Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The courses in the biological sciences and the electives must be selected with the approval of the adviser. The electives may be in the biological sciences, in education, or, in exceptional cases, in other fields.

BOTANY

Candidates for advanced degrees in botany must have had at least twenty hours of undergraduate work in botany, including courses 3, 6, and 22, or fifteen hours in botany and five hours in a related subject acceptable to the department. Graduate students who elect botany for minor credit must have had fifteen hours in botany, or ten hours in botany and five hours in a related subject acceptable to the department.

Attention is called to courses in agronomy, bacteriology, chemistry, entomology, geography, geology, horticulture, mathematics, physics, physiology, and zoology, which are available to advanced students and offer a broad foundation for the different phases of botanical work. The work in plant sciences in the College of Agriculture and the Agricultural Experiment Station offers unusual facilities to graduate students. Joint majors may be arranged in botany and agronomy, or botany and horticulture.

Courses for Graduates

100. Research.—Both semesters. *One-half to four units.* Work may be taken in the following fields, subject to approval of one of the staff:
   (a) Plant Morphology.—Associate Professor Tippo.
   (b) Plant Physiology.—Associate Professor Fuller.
   (c) Systematic Botany of Vascular Plants and Bryophytes.—Associate Professor Jones.
   (d) Mycology.—Professor Stevens, Assistant Professor Shanor.
   (e) Plant Pathology.—Same as Agronomy 118b and Horticulture 150. Professors Stevens, Anderson, Koehler.
   (f) Plant Ecology or Geography.—Professor Vestal.
   (g) Plant Anatomy.—Associate Professor Tippo.
   (h) Photosynthesis.—Professors Emerson, Rabinowitch.

110. Botanical Discussions.—Required of all graduate students in botany. Once a week; both semesters. *One-fourth unit, or no credit.* Members of the department.

112. Discussions in Plant Morphology and Systematic Botany.—Once a week; both semesters. *One-fourth unit.* Associate Professors Tippo, Jones.

113. Discussions in Plant Physiology.—Once a week; both semesters. *One-fourth unit.* Associate Professor Fuller.

117. Discussions in Plant Pathology and Mycology.—Once a week; both semesters. *One-fourth unit.* Professor Stevens.

119. Discussions in Photosynthesis.—Once a week; both semesters. *One-fourth unit.* Professor Emerson, first semester; Professor Rabinowitch, second semester.

133. Advanced Physiology of Growth, Response, and Reproduction.—Three times a week; first semester. *One-half unit.* (Given in 1947-1948 and in alternate years.)

171. Mycology of Special Groups.—Once a week; four hours; second semester. *One-half unit.* Professor Stevens, Assistant Professor Shanor.
172. Epidemiology of Plant Diseases.—Once a week; first semester. *One-half unit.* Professor Stevens.
177. Virus Diseases of Plants.—Same as Horticulture 177. Twice a week; second semester. *One unit.* (Given in 1947-1948 and in alternate years.) Associate Professor Thornberry.

Courses for Graduates and Advanced Undergraduates

7. Plant Pathology.—Causes, diagnosis, and treatment of plant diseases. Three times a week; first semester. Professor Stevens.
20. Cytology.—Twice a week; second semester. (Not given in 1947-1948.) Professor Buchholz.
22. General Plant Morphology.—Three times a week; first semester. Dr. Stewart.
33. Plant Physiology.—Growth, and the effect of environment on growth. Twice a week; first semester. (Given in alternate years; not given in 1947-1948.) Associate Professor Fuller.
35. Physiology: Metabolic Transformations.—Three times a week; second semester. (Given in 1947-1948 and in alternate years.)
40. Histological Technic.—Survey of technics used in the preparation of plant tissues for microscopical examination. Three times a week; first semester. Associate Professor Tippo.
41. Bryophytes.—Morphology and classification. Three times a week; first semester. Associate Professor Jones.
43. Pteridophytes.—Comparative morphology. Twice a week; first semester. (Given in alternate years; not given in 1947-1948.) Professor Buchholz.
45. Plant Anatomy.—Internal structure of vascular plants with emphasis on function and evolutionary history. Three times a week; first semester. (Not given in 1947-1948.) Associate Professor Tippo.
46. Heredity and Evolution.—The cell in inheritance, environment, adaptation, and evolution. Once a week; second semester. (Given in alternate years; not given in 1947-1948.) Professor Buchholz.
51. Fruit Diseases.—Same as Horticulture 51. Three times a week; first semester. (Given in 1947-1948 and in alternate years. Professor Anderson.
52. Vegetable Diseases.—Same as Horticulture 52. Three times a week; first semester. (Given in alternate years; not given in 1947-1948.) Professor Anderson.
55. Plant Geography of North America.—Regional divisions; climate, soil, topography, vegetation, vegetational history. Twice a week; first semester. Professor Vestal.
56. Plant Geography.—Plants and vegetation of continents other than North America; geographic relations of floras. Twice a week; first semester. (Given in alternate years; not given in 1947-1948.) Professor Vestal.
60. Advanced Systematic Botany.—Phylogenetic study of flowering plants; relationship of the principal orders and families, problems of nomenclature and the identification of species. Twice a week; first semester. Associate Professor Jones.
72. General Mycology.—Structure, classification, and identification of fungi, including those of economic importance. Three times a week; second semester. Assistant Professor Shanor.
77. Diseases of Field Crops.—Three times a week; second semester. (Given in alternate years; not given in 1947-1948.) Professor Stevens.
81. Plant Ecology.—Principles of ecology as exemplified by vegetation and environments of Illinois. Field study on four or five Saturdays. Twice a week; first semester. Professor Vestal.
88. Ecology: Plant Communities.—Characteristics, composition, and classes of vegetation units. Twice a week; second semester. (Given in 1947-1948 and in alternate years.) Professor Vestal.

BUSINESS ORGANIZATION AND OPERATION

(Including Accountancy and Business Law)

ACCOUNTANCY

Candidates for the Master of Science or Doctor of Philosophy degree in Accountancy must have had the equivalent of twenty hours of undergraduate work in accountancy and at least one course each in principles of economics and finance. Graduate students in other departments who choose accountancy as a minor must present similar courses, with fifteen instead of twenty hours in accountancy as a minimum.

Courses for Graduates

101. Concepts and Principles.—Twice a week; first semester. *One unit.* Professor Littleton.
103. Income Determination.—Twice a week; second semester. *One unit.* Professor Littleton.
104a-104b. Accounting Systems.—Twice a week; both semesters. *One unit.* Professor Baily.
106. Cost Accounting.—Twice a week; first semester. *One unit.* Professor Schlatter.
107. Surplus and Dividends.—Twice a week; second semester. *One unit.* Professor Littleton.
109. Accounting History.—Twice a week; first semester. *One unit.* Professor Littleton.
110. Accounting Reports.—Twice a week; second semester. *One unit.* Professor Scovill.
113. Governmental Accounting.—Twice a week; first semester. *One unit.* Professor Morey.
120. Income Tax Development.—Twice a week; second semester. *One unit.* Assistant Professor Gaa.
129. Thesis.—Once a week; both semesters. *One unit.* Professor Littleton and members of the staff.

Courses for Graduates and Advanced Undergraduates

3a. Advanced Accounting.—Three times a week; both semesters. Associate Professors Newcomer, Moyer.
3b. Auditing.—Three times a week; both semesters. Associate Professor Moyer.
4a. Cost Accounting.—Twice a week; both semesters. Professor Schlatter, Associate Professor Theiss, Assistant Professor Dickey.
4b. Accounting Systems.—Twice a week; both semesters. Professor Baily, Assistant Professor Carrithers.
5a-5b. C.P.A. Problems.—Three times a week; both semesters. Professor Scovill, Associate Professors Newcomer, Moyer.
13. Governmental Accounting.—Twice a week; both semesters. Professor Borth.
20. Income Tax Procedure.—Three times a week; both semesters. Assistant Professor Gaa.
30. Budgets and Accounting Control.—Three times a week; both semesters. Associate Professor Theiss.

BUSINESS ORGANIZATION AND OPERATION

Work may be done in the field of business organization and operation for a major or a minor for the Master of Science degree, and for a minor for the Doctor of Philosophy degree. To do major work in this field, a student must have completed at least twenty hours of undergraduate work in marketing, management, business administration, economics, business law, or accountancy. To do minor

work in this field, a student must have had at least twelve hours of work in the subjects named above. To do work either in marketing or management, the student must have completed a course in the fundamentals of the subject.

Courses for Graduates

102a-102b. Marketing Principles and Problems.—Twice a week; both semesters. *One unit.* Professor Converse.

104a-104b. Scientific Management.—Modern management methods and procedures, particularly as they apply to industrial enterprises. Twice a week; both semesters. *One unit.* Professor Anderson.

107a-107b. Sales Campaigns.—Twice a week; both semesters. *One unit.* Professor Sandage, Associate Professor Beach.

126. Analysis of Consumer Markets.—Once a week; second semester. *One unit.* Professor Converse.

127. Prices and Price Policies.—Once a week; first semester. *One unit.* Associate Professor Huegy.

129. Seminar.—Time to be arranged; both semesters. *One unit.* Members of the staff.

Courses for Graduates and Advanced Undergraduates

4. Management in Manufacturing.—Three times a week; both semesters. Professor Anderson.

8. Introduction to Advertising.—Three times a week; both semesters. Assistant Professors Luck, Wedding.

9. Trade Associations and Commercial Organizations.—Twice a week; second semester. Assistant Professor Wedding.

14. Technique of Executive Control.—Three times a week; first semester. Professor Anderson.

17. Problems in Sales Administration.—Twice a week; both semesters. Associate Professor Beach.

18. Advertising Campaigns.—Same as Journalism 38. Three times a week; both semesters. Assistant Professor Wedding.

20. Credits and Collections.—Three times a week; first semester. Associate Professor Huegy.

22. Marketing Research and Policies.—Three times a week; first semester. Professor Converse.

27. Advanced Salesmanship.—Twice a week; first semester. Associate Professor Beach.

30. Problems in Retail Store Management.—Twice a week; first semester. Assistant Professor Jones.

32. Contemporary Problems in Marketing Management.—Three times a week; second semester. Associate Professor Huegy.

BUSINESS LAW

Course for Graduates and Advanced Undergraduates

10. Law of Security Relations and Banking.—Three times a week; both semesters. Professor Dillavou.

CERAMIC ENGINEERING

This department offers graduate work leading to the degrees of Master of Science in Ceramics, Master of Science in Ceramic Engineering, Doctor of Philosophy in Ceramics, and Doctor of Philosophy in Engineering.

The prerequisite for a major in graduate work in ceramics or ceramic engineering is proficiency in the undergraduate courses required for the degree of Bachelor of Science in the branch of the subject in which registration is desired, or substantial equivalents.

Candidates for the degree of Doctor of Philosophy in Ceramics must have had the equivalent of at least twenty-five semester hours of satisfactory courses in general, analytical, physical, and organic chemistry; also calculus, one year of college physics, one semester of optical mineralogy, and at least eighteen semester hours or their equivalent in acceptable ceramic courses.

Courses for Graduates

110. Ceramic Chemistry.—Twice a week; first semester. *One unit.* Professor Andrews.
111. Ceramics.—Twice a week; second semester. *One to two units.* Professor Andrews.
112. Drying.—Twice a week; first or second semester. *One to two units.* Professor Hursh.
113. Porcelain Enamels.—Twice a week; first or second semester. *One to two units.* Professor Andrews.
114. Firing.—Twice a week; first or second semester. *One to two units.* Professor Hursh.
115. Glass.—Twice a week; both semesters. *One to two units.* Professor Tooley.
116. Refractories.—Twice a week; first or second semester. *One to two units.* Professor Hursh.
117. Special Ceramic Bodies or Glazes.—Twice a week; first or second semester. *One to two units.*
118. Materials and Special Problems.—Twice a week; both semesters. *One to two units.* Professors Andrews, Hursh, Tooley, Cook.
190. Research.—Twice a week; both semesters. *One to two units.* Professors Andrews, Hursh, Tooley, Cook.

Courses for Graduates and Advanced Undergraduates

33. Ceramic Technology.—Five times a week; first semester. Professor Cook.
34. Ceramic Technology.—Five times a week; second semester. Professor Cook.
35. Principles of Drying.—Three times a week; first semester. Professor Hursh.
36. Kilns, Furnaces, and Firing Operations.—Three times a week; second semester. Professor Hursh.
37. Pyrometry.—Twice a week; both semesters. Assistant Professor Allen.
38. Dryer and Furnace Design.—Twice a week; first semester. Professor Hursh.
39. Ceramic Engineering Design.—Three times a week; second semester. Professor Hursh.
40. Ceramic Bodies and Glazes.—Four times a week; first semester. Professor Cook.
41. Refractories.—Twice a week; second semester. Assistant Professor Allen.
42. Ceramic Microscopy.—Three times a week; both semesters. Assistant Professor Allen.
43. Cements, Limes, and Plasters.—Twice a week; first semester. Professor Cook.
44. Elementary Glass Technology.—Three times a week; second semester. Professor Tooley.
45. Advanced Glass Technology.—Twice a week; first semester. Professor Tooley.
46. Porcelain Enamels.—Four times a week; second semester. Professor Cook.

CHEMISTRY

(Including Chemical Engineering)

Students who intend to take graduate work for an advanced degree in chemistry should include in their undergraduate preparation at least the equivalent of one full year of physics, one year of French, one year of German, and mathematics

through differential and integral calculus. Any student without the necessary physics or mathematics may enter the Graduate School but will be required to spend part of his time in residence to remove the deficiency. In order to be admitted as a candidate for an advanced degree in chemistry a student must have had one year of college French or German (preferably German). Where the applicant has done two or three years of work in French or German in secondary school, the requirement will be considered to be met provided at least one semester of the language more advanced than his secondary school work has been done in college. Four years of French or German completed in a secondary school will be accepted in lieu of any college work in the subject. An applicant who has a knowledge of French or German, but who lacks formal credentials, may be examined to determine his language status. Such an applicant should correspond with the Director of Admissions and Records with reference to this examination.

In meeting the language requirements for the degree of Doctor of Philosophy in Chemistry, a student may substitute Russian for French on the direct recommendation of the Department of Chemistry (and without formal petition), provided that such recommendation is approved by the Dean of the Graduate School.

Candidates for an advanced degree in chemistry must have had the equivalent of twenty-five semester hours in chemistry, properly distributed.

Candidates for the Master of Arts or Master of Science degree with a major in chemistry must include among their courses Chemistry 40 and 41, or must have had the equivalent.

Candidates for the Doctor of Philosophy degree in any branch of chemistry must include among their courses Chemistry 40, 41, 42, and 43, or must have had the equivalent.

Graduate students whose major subject is in some department other than chemistry, before taking chemistry courses for graduate credit, must have had the equivalent of fifteen semester hours in chemistry, and the ground covered should include satisfactory work in general chemistry and in qualitative and quantitative analysis and elementary organic chemistry. Such students are advised to make selections from the following courses: Chemistry 40, 41, 42, 43, 27, 36-37, 50, 15, 16, and 29b. Courses of a more special nature will not, as a rule, be accepted for graduate work unless preceded by one of the courses above.

Those who intend to take a first minor in chemistry or any branch of chemistry toward the Doctor of Philosophy degree must include among their courses Chemistry 40 and 41, or must have had the equivalent.

Candidates for the degree of Master of Science in the Teaching of Chemistry must earn four units in chemistry, two units in education, and two units in electives. Requirements are chemistry, 4 units; Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The courses in chemistry and the electives must be selected with the approval of the adviser. The electives may be in chemistry, in education, or, in exceptional cases, in other fields.

For work in physical sciences, see page 85.

Courses for Graduates

Inorganic Chemistry

101b. Inorganic Chemistry.—The less familiar elements and their relationship in the periodic system. Lectures and recitations. Three times a week; second semester. *Three-fourths unit.* Associate Professor Moeller.

102b. INORGANIC CHEMISTRY.—Inorganic preparations and qualitative analysis of the less familiar elements. Laboratory to accompany or follow Chemistry 101b. One to three times a week; second semester. *One-fourth to three-fourths unit.* Associate Professor MOELLER.

105a-105b. INORGANIC CHEMISTRY.—Seminar. Current literature. Required of all students whose major is inorganic chemistry. Once a week; both semesters. *One-fourth unit.* Professor BAILAR.

106a-106b. SPECIAL TOPICS IN INORGANIC CHEMISTRY.—Lectures, discussions, and reports. Twice a week; both semesters. *Three-fourths unit.* Professors BAILAR, AUDRIETH.

Analytical Chemistry

123a. QUALITATIVE ANALYSIS.—Advanced principles, calculations, methods, including organic reagents, and applications. Lectures and laboratory. Required of all graduate students whose major or minor is analytical chemistry. Three times a week; first semester. *Three-fourths unit.* Professor LAITINEN.

124b. QUANTITATIVE ANALYSIS.—Advanced principles, calculations, experimental methods, and applications. Lectures. Required of all graduate students whose major or minor is analytical chemistry. Twice a week; second semester. *One-half unit.* Professor SMITH.

124d. QUANTITATIVE ANALYSIS.—Laboratory, optional, to accompany Chemistry 124b. Twice a week; second semester. *One-half unit.* Professor SMITH.

125a-125b. ANALYTICAL CHEMISTRY.—Seminar. Special topics in analytical chemistry. Required of all graduate students whose major or minor is analytical chemistry. One to three times a week; both semesters. *One-fourth to one unit.* Professor CLARK.

126a-126b. OPTICAL AND OTHER INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS.—Spectroscopy, polarimetry, refractometry, spectrophotometry, colorimetry; polarography, potentiometric, amperometric, and conductometric titrations, mass spectrometry, dielectric and supersonic methods, electron microscopy, and other selected topics. Lectures and laboratory. Three times a week; both semesters. *Three-fourths unit.* Professors ENGLIS, LAITINEN.

127a-127b. APPLIED X-RAYS.—Lectures. Twice a week; both semesters. *One-half unit.* Professor CLARK.

127c-127d. APPLIED X-RAYS.—Laboratory, optional, to accompany Chemistry 127a-127b. Twice a week; both semesters. *One-half unit.* Professor CLARK.

Organic Chemistry

130a. ORGANIC CHEMISTRY.—Survey of organic chemistry designed for first-year graduate students. Three times a week; first semester. *One unit.* Professor MARVEL.

132b. ORGANIC CHEMISTRY.—Advanced survey of organic chemistry (to follow Chemistry 130a). Three times a week; second semester. *One unit.* Professor SNYDER.

133a. ORGANIC CHEMISTRY.—Optical isomerism, *cis-trans* isomerism, tautomerism, chemistry of the carbohydrates, etc. Twice a week; first semester. *Three-fourths unit.* Assistant Professor LEONARD.

134a. ORGANIC CHEMISTRY.—Advanced organic synthesis. Laboratory. Two to four times a week; first semester. *One-half to one unit.* Professor SNYDER.

135a-135b. ORGANIC CHEMISTRY.—Seminar. Current literature. Once a week; both semesters. *One-fourth unit.* Professor ADAMS.

136b. ORGANIC CHEMISTRY.—Newer methods in organic laboratory procedure. Two to four times a week; second semester. *One-fourth to one unit.* Assistant Professor FRANK.

Physical Chemistry

140a. PHYSICAL CHEMISTRY.—Survey of physical chemistry designed for first-year graduate students who have had one year of physical chemistry. Lectures. Twice a week; first semester. *Three-fourths unit.* Professor RODEBUSH.

141a-141b. THE SPECTRA AND STRUCTURE OF POLYATOMIC MOLECULES.—Determination of bond lengths, dissociation energies, molecular symmetry, functional groups. Three times a week; both semesters. *Three-fourths unit.* Assistant Professor MILLER.

142a-142b. CHEMICAL THERMODYNAMICS.—Fundamental laws and calculation of thermodynamic quantities. Lectures. Three times a week; both semesters. *One unit.* Professor WALL.

144a-144b. PHYSICAL CHEMISTRY.—Kinetic theory, statistical mechanics, molecular dynamics. Lectures. Twice a week; both semesters. *Three-fourths unit.* Professor WALL.

145a-145b. PHYSICAL CHEMISTRY.—Seminar. Recent development in physical chemistry. Twice a week; both semesters. *Three-fourths unit.* Professors RODEBUSH, WALL.

Biochemistry

150b. BIOCHEMISTRY.—Chemistry of intermediary metabolism. Lectures, discussions, and readings. Twice a week; second semester. *Three-fourths unit.* Professor ROSE.

152a-152b. BIOCHEMISTRY.—Difficult biochemical preparations; analytical methods. Chiefly laboratory. One to five times a week; both semesters. *One-half to one unit.* Professor ROSE.

155a-155b. BIOCHEMISTRY.—Seminar. Current literature. Required of all graduate students whose major is biochemistry. Twice a week; both semesters. *Three-fourths unit.* Professor ROSE.

Water Chemistry

185a-185b. CHEMISTRY OF WATER TREATMENT.—Seminar. Special problems and new developments in sanitary chemistry. Once a week; both semesters. *One fourth to one and one-fourth units.* Professor BUSWELL.

Miscellaneous

190a-190b. RESEARCH.—Candidates for the Master of Arts or Master of Science degree who elect research are required to present a thesis. A thesis is always required of students taking the Doctor of Philosophy degree. Not all candidates for thesis work necessarily will be accepted. Students whose major is in departments other than chemistry must receive permission from the Head of the Department of Chemistry to register in this course. Both semesters. *One-fourth to four units.* Work may be taken in the following fields, subject to the approval of one of the qualified staff members:

PHYSICAL CHEMISTRY.—Professors RODEBUSH, PHIPPS, WALL, Assistant Professor MILLER.

INORGANIC CHEMISTRY.—Professors BAILAR, LAITINEN, AUDRIETH, Associate Professor MOELLER, Assistant Professor MARTIN.

ANALYTICAL CHEMISTRY.—Professors CLARK, SMITH, LAITINEN, ENGLIS.

APPLIED X-RAYS AND ELECTRON MICROSCOPY.—Professor CLARK.

FOOD CHEMISTRY; PHYTOCHEMISTRY.—Professor ENGLIS.

ORGANIC CHEMISTRY.—Professors ADAMS, MARVEL, FUSON, SNYDER, Assistant Professors FRANK, LEONARD.

BIOCHEMISTRY.—Professors ROSE, CARTER, Assistant Professor VESTLING.

WATER CHEMISTRY; ZYMOCHEMISTRY.—Professor BUSWELL.

CERAMIC CHEMISTRY.—Professor ANDREWS.

192a. CHEMICAL LITERATURE AND REFERENCE WORK.—Once a week; first semester. *One-fourth unit.* Assistant Professor BARTOW.

Courses for Graduates and Advanced Undergraduates

Inorganic Chemistry

15. INORGANIC CHEMISTRY.—Periodic relationship, preparation, and application of the common elements and compounds. Three times a week; both semesters. Professor AUDRIETH.

16. Inorganic Chemistry.—Preparation of the less easily produced inorganic compounds. Laboratory. One to three times a week; both semesters. Professor Audrieth.

Analytical Chemistry

25b. Survey of Analytical Chemistry.—An intensive review of the fundamental principles and procedures of qualitative and quantitative analysis. Three times a week; second semester. Not open to students who have had Chemistry 10 or 24. Professor Laitinen.

26a. Chemical Analysis and Treatment of Water.—Chemical and instrumental methods for analysis of water and determination of quality; chemical principles and processes in water purification and conditioning; relationship of chemistry of water to municipal and industrial use. Lectures and demonstrations. Three times a week; first semester. *One-half unit.* Professor Englis.

27. Special Methods and Instruments in Quantitative Analysis.—Three times a week; both semesters. Professor Smith.

28a. Qualitative Microanalysis.—Topics include chemical microscopy and optical crystallography; electron microscopy. Conferences and laboratory. Three times a week; first semester. Professor Clark.

29b. Food Analysis.—Quantitative organic analysis of food products; alcohols, carbohydrates, fats and oils, cereals, nitrogenous bodies, preservatives, and colors. Six times a week; second semester. Professor Englis.

Organic Chemistry

36. Organic Chemistry.—Second course. Lectures and recitations. Three times a week; both semesters. Assistant Professor Frank.

37. Organic Chemistry.—Organic synthesis. Laboratory, to accompany Chemistry 36. Twice a week; both semesters. Assistant Professor Frank.

38. Systematic Identification of Organic Compounds.—Identification of pure organic compounds and mixtures. Twice a week; both semesters. Professor Snyder, Assistant Professor Leonard.

Physical Chemistry.

40. Elementary Physical Chemistry.—Three times a week; both semesters. Professors Rodebush, Wall.

41. Elementary Physical Chemistry.—Laboratory, to accompany Chemistry 40. Once a week; both semesters. Professor Phipps, Assistant Professor Miller.

42. Elementary Physical Chemistry.—Three times a week; both semesters. Professor Phipps, Assistant Professor Miller.

43. Elementary Physical Chemistry.—Laboratory, to accompany Chemistry 42. Once a week; both semesters. Professor Phipps, Assistant Professor Miller.

44a. Advanced Physical Chemistry.—Thermodynamics and free energy calculations. Twice a week; first semester. Assistant Professor Miller.

46b. Advanced Physical Chemistry.—Atomic structure. Twice a week; second semester. Professor Rodebush.

49b. Chemistry of Colloids.—Preparation and properties of colloids. Special apparatus and technique employed in colloid chemistry. Lectures and demonstrations. Three times a week; second semester.

Biochemistry

50. Biochemistry.—Proteins, fats, and carbohydrates; tissues, digestion, intestinal putrefaction, and feces; quantitative analysis of gastric contents, blood, milk, and urine. Lectures and laboratory. Five times a week; both semesters. Professors Rose, Carter, Assistant Professor Vestling.

51b. Techniques of Blood Analysis and Their Applications.—Lectures and laboratory. Three times a week; second semester. Professor Carter.

52b. Biochemistry of Vitamins and Hormones.—Lectures and readings. Twice a week; second semester. Professor Carter.

Miscellaneous

95a. History of Science with Particular Reference to Chemistry.—Lectures and readings. Twice a week; first semester. Assistant Professor Bartow.

97. Radiochemistry.—For advanced undergraduate and graduate students in the fields of inorganic, analytical, or physical chemistry. Lectures. Twice a week; both semesters. Assistant Professor Duffield.

98. Radiochemistry.—Laboratory to accompany Chemistry 97. Once a week; both semesters. Assistant Professor Duffield.

CHEMICAL ENGINEERING

The Department of Chemistry offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy in Chemical Engineering. Candidates for these degrees should have had undergraduate training comparable to that offered at the University of Illinois, including mathematics through calculus, and year courses in physics, mechanics, and electrical engineering. Students who enter without the usual engineering courses prescribed in the undergraduate chemical engineering curriculum will be required to make up their deficiencies to the extent prescribed by their adviser.

Candidates for an advanced degree in chemical engineering must have had the equivalent of twenty-five hours in chemistry, including organic and physical chemistry.

A reading knowledge of German, and French or Russian is recommended for all graduate students in chemical engineering. In meeting the language requirements for the degree of Doctor of Philosophy in chemical engineering, a student may substitute Russian for French on the direct recommendation of the Department of Chemistry (and without formal petition), provided that such recommendation is approved by the Dean of the Graduate School.

Candidates for the Master of Science degree in Chemical Engineering must include Chemical Engineering 87 and 88 among their courses.

A student who chooses chemical engineering as a minor must take at least two units of work in this subject for the Master of Science degree, or four units for the Doctor of Philosophy degree.

Courses for Graduates

163. Evaporation, Drying, Humidification, and Dehumidification.—Lectures. Twice a week; first semester. *Three-fourths unit.* (Given in 1947-1948 and in alternate years.) Professor Johnstone.

164. Absorption and Extraction.—Lectures. Twice a week; first semester. *Three-fourths unit.* (Given in alternate years; not given in 1947-1948.) Professor Johnstone.

165a-165b. Chemical Engineering.—Seminar. Required of all graduate students whose major is chemical engineering. Once a week; both semesters. *One-fourth unit.* Professor Johnstone and staff.

166. Filtration and Separation.—Lectures. Twice a week; second semester. *Three-fourths unit.* (Given in alternate years; not given in 1947-1948.) Professor Johnstone.

167. Distillation.—Lectures. Twice a week; second semester. *Three-fourths unit.* (Given in 1947-1948 and in alternate years.) Professor Comings.

168. Economic Balance and Plant Design.—Lectures. Twice a week; second semester. *Three-fourths unit.* (Given in 1947-1948 and in alternate years.) Professor Johnstone.

190a-190b. Research.—Candidates for the Master of Science degree who elect research are required to present a thesis. A thesis is always required of

students taking the Doctor of Philosophy degree. Not all candidates for thesis work necessarily will be accepted. Students whose major is in other departments must receive permission from the Head of the Department of Chemistry to register in this course. Both semesters. *One-fourth to four units.* Professors JOHNSTONE, SWANN, STRAUB, COMINGS, Assistant Professor DRICKAMER.

Courses for Graduates and Advanced Undergraduates

70. CHEMICAL ENGINEERING THERMODYNAMICS.—Fundamental concepts and laws of thermodynamics, primarily for students in chemical engineering. Lectures and problems. Three times a week; both semesters.
71. PRINCIPLES OF CHEMICAL ENGINEERING.—First course. Lectures and problems. Four times a week; both semesters. Professor COMINGS.
72. UNIT OPERATIONS.—Laboratory, to accompany Chemical Engineering 71. Once a week; both semesters. Mr. HOUGEN.
73. PRINCIPLES OF CHEMICAL ENGINEERING.—Second course. Lectures and problems. Four times a week; second semester. Assistant Professor DRICKAMER.
74. UNIT OPERATIONS.—Laboratory, to accompany Chemical Engineering 73. Once a week; second semester. Mr. HOUGEN.
77. CHEMICAL TECHNOLOGY.—Modern industrial chemical processes. Three times a week; both semesters. Mr. HOUGEN.
79. CHEMICAL ENGINEERING PROJECTS.—Laboratory. Development of an individual project. Once a week; both semesters. Professor JOHNSTONE.
80. CHEMICAL ENGINEERING CALCULATIONS.—Three times a week; second semester. Professor JOHNSTONE.
81. PLANT DESIGN.—Comprehensive problems. Three times a week; second semester.
82. HIGH PRESSURE REACTIONS.—Twice a week; second semester. Professor COMINGS.
83. APPLIED ELECTROCHEMISTRY.—Lectures. Twice a week; first semester. Professor SWANN.
84. POWER PLANT AND BOILER WATER PROBLEMS.—Lectures. Twice a week; first semester. Professor STRAUB.
87. FLOW OF FLUIDS.—Advanced course for chemical engineering students. Lectures and problems. Twice a week; first semester. Professor COMINGS.
88. HEAT TRANSMISSION.—Advanced course for chemical engineering students. Lectures and problems. Twice a week; first semester. Professor COMINGS.
89. CATALYSIS.—Lectures. Twice a week; second semester. (Given in alternate years; not given in 1947-1948.) Assistant Professor DRICKAMER.

CITY PLANNING

(See Landscape Architecture)

CIVIL ENGINEERING

(Including Sanitary Engineering)

The graduate student in civil engineering generally follows one of three fields, transportation and municipal engineering, hydrallic engineering, or structural engineering. The work leads to the degree of Master of Science in Civil Engineering and to the degree of Doctor of Philosophy in Engineering.

The prerequisite for graduate work in civil engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in the branch of the subject in which registration is desired.

Sanitary Engineering. — The work in sanitary engineering leads to the degree of Master of Science in Sanitary Engineering and to the degree of Doctor of Philosophy in Engineering. The prerequisite for admission to the first year of graduate study is a degree of Bachelor of Science in Sanitary Engineering, or the satisfactory completion of the sanitary option in a course in civil engineering, including basic courses in bacteriology, quantitative chemical analysis, and organic chemistry, or their equivalent in the fields of chemistry and biology.

This listing of courses as to semesters is tentative and some adjustments can be made to meet student needs.

Courses for Graduates

120a. Highway Engineering.—Highway transportation, airport design, street layouts, regional plans, and pavements for cities. Twice a week; first semester. *One unit.* Professor Crandell.

123. Highway Traffic, Transport, and Safety.—Traffic growth, characteristics, surveys, regulations, and signaling; private and commercial transportation by automobile, bus, and truck; transport organization and regulation; accident surveys, analysis, and prevention. Twice a week; first or second semester. *One unit.* Professor Wiley.

124. Airport Design.—Requirements of site; arrangement of various facilities; location, soil studies, grading, drainage and surfacing of runways; general features of hangars, shops, and other buildings. Three times a week; first semester. *One unit.* Professors Crandell, Doland, Shedd, Peck.

125. Railway Location and Operation.—Railway location; track capacity; tonnage ratings. Once a week; first or second semester. *One unit.* Assistant Professor Hay.

135. Municipal Engineering.—City finances and budgets, the work of the city manager and city engineer, zoning, playgrounds and parks, street cleaning, smoke prevention, and fire prevention. Twice a week; second semester. *One unit.* Professor Crandell.

140a. Water Supply.—Design, pumping machinery, administration, operation. Twice a week; first semester. *One unit.* Professor Babbitt.

143. Sewerage.—Sewer design, construction, maintenance, operation, and financing. Twice a week; second semester. *One unit.* Professor Babbitt.

144. Sewage Disposal, Wastes Disposal, and General Sanitation.—Principles and design of sewage treatment and waste disposal works. Twice a week; second semester. *One unit.* Professor Babbitt.

146. Public Health Engineering.—Design of water purification works and principles of sanitation. Twice a week; first semester. *One unit.* Professor Babbitt.

148. Sanitary Engineering Laboratory.—Tests of water supply, sewerage, water purification and sewage treatment equipment and processes. First or second semester. *One to two units.* Professor Babbitt.

150. Hydrology and Flood Control.—Magnitude and frequency of flood flow of streams, minimum flow of streams and regulation of flow by storage reservoirs, intense rainfall and the development of intensity curves for use in rational run-off formula, unit-graph method of computing flood run-off, flood control and prevention by channel improvement, levees, and reservoirs. Twice a week; first or second semester. *One unit.* Professor Doland.

152. Water Resources Planning and Development.—Purposes and techniques of planning water resources developments; methods of evaluating the engineering and economic aspects of water conservation projects developed through the examination of actual proposals. Twice a week; second semester. *One unit.* Professor Doland.

155. Water Power.—Preliminary investigations, selection of site, storage requirements, structures, machinery, etc. Twice a week; second semester. *One unit.* Professor Doland.

161. Structural Theory and Design.—General theory of continuity; moment distribution; the column analogy; rigid frame bridges and buildings; fixed and continuous arches; classification of structures from viewpoint of design. Twice a week; both semesters. *One or two units.* Professors Shedd, Vawter.

162. Structural Theory and Design.—Statically indeterminate trusses; continuous trusses; steel arches; secondary stresses; suspension bridges; long-span roofs; skeleton steel buildings. Twice a week; both semesters. *One to two units.* Professors Shedd, Vawter.

164. Reinforced Concrete Design.—Theories of action of beams, slabs, and columns of reinforced concrete; codes and specifications and their influence on design; effect of continuity. Twice a week; both semesters. *One unit.* Professor Shedd.

165. Steel Design.—Design of steel members; codes and specifications for buildings; riveted and welded connections; evolution of bridge specifications; loads and working stresses; economic proportions. Twice a week; both semesters. *One unit.* Professor Shedd.

169. Wood Structures.—Theory and practice in the design of modern wood structures; the effect of the plant origin and physical structure of wood on its mechanical strength; fasteners and their significance in design and the development of design formulae. Twice a week; first semester. *One unit.* Professor Oliver.

170. Earth and Masonry Structures.—Design and construction of dams, retaining walls, abutments and piers, culverts, grain elevators and bins. Three times a week; both semesters. *One unit.* Professor Huntington.

173. Soil Mechanics.—Physical properties of soils; identification and description of soils; permeability, compressibility, consolidation, and shearing resistance; deformation and drainage characteristics. Theories of soil mechanics; earth pressure, stability, settlement, seepage, and consolidation. Twice a week; first semester. *One unit.* Professor Peck, Assistant Professor Bauer, Dr. Terzaghi, Mr. Cummings.

174. Soil Mechanics.—Practical considerations; boring, sampling, testing; retaining walls, open cuts, slides, dams and embankments; foundations, settlements due to excavation and other causes; field observations. Limitations and alternatives to conventional procedures of design and construction. Further study in any phase of this course can be pursued under Civil Engineering 190. Twice a week; second semester. *One unit.* Professor Peck, Dr. Terzaghi, Mr. Cummings.

181. Advanced Structural Analysis: Approximate Methods.—Methods of successive approximations and numerical procedures for the solution of complex problems, with applications to bridges, buildings, and aircraft structures. Method of successive relaxation of constraints, energy methods, difference equations, numerical integration procedures, method of collocation, method of least squares, and Galerkin's method. Three times a week; first or second semester. *One to two units.* Professor Newmark.

182. Advanced Structural Analysis: Buckling, Vibrations, and Impact.—Elastic and inelastic instability of bars, plates, and plates with stiffeners. Vibrations of structures including earthquake effects. Action of simple structural elements and of more complex structures subjected to dynamic loads, with applications to bridges, buildings, and aircraft structures. Three times a week; first or second semester. *One to two units.* Professor Newmark.

185. Analytical Study of Tests of Structural Steel Members.—Planning tests, limitations of experimental methods, interpretation of results in terms of design practice. Twice a week; second semester. *One unit.* Professor Wilson.

186. Advanced Aircraft Structures.—Analysis and design of frames and individual members of aircraft structures. Twice a week; first and second semesters. *One to two units.* Associate Professor Clark.

190. Special Problems.—Individual investigations or studies of various phases of civil engineering. Both semesters. *One-half to two units.* Members of the department.

198. Thesis.—Both semesters. *One to two and one-half units.* Members of the department.

Courses for Graduates and Advanced Undergraduates

Note: Other advanced undergraduate courses are available, upon the approval of the adviser and the Dean, to meet the needs of individual students.

67-68. Statically Indeterminate Structures.—Elastic theory and its application to statically indeterminate structures. Three times a week; both semesters. Professor Shedd.

THE CLASSICS

For the degree of Master of Arts in the Classics, the major may be either Latin or Greek.

The degree of Doctor of Philosophy is given in classical philology. Major work may be taken in either Latin or Greek, but whichever language is taken as a major, the other one must be taken as a first minor.

GREEK

Preparation for first-year graduate work in Greek should include at least three years of college Greek, or equivalent, and two years of college Latin. A reading knowledge of French and German is important for candidates in this subject. The study of history and philosophy is especially recommended.

Courses for Graduates

104a-104b. Homer.—Twice a week; both semesters. *One unit.* (Not given in 1947-1948.)

105a. Aristotle's Ethics.—Twice a week; first semester. *One unit.* (Not given in 1947-1948.)

106a. Greek Drama: Tragedy.—Four times a week; first semester. *One unit.* (Not given in 1947-1948.)

106b. Greek Drama: Comedy.—Twice a week; second semester. *One unit.* (Not given in 1947-1948.) Professor Perry.

108. Herodotus.—Twice a week; first semester. *One unit.* (Not given in 1947-1948.)

110a-110b. Bibliography and Criticism.—Thesis course. Same as Latin 110a-110b. Once a week; both semesters. *One unit.* Associate Professor Oliver.

119. Greek Lyric Poetry.—Twice a week; first semester. *One unit.* Professor Turyn.

120. Theocritus.—Twice a week; first semester. *One unit.* (Not given in 1947-1948.) Professor Perry.

121. Thucydides.—Twice a week; second semester. *One unit.* Visiting Professor Smith.

122. Lucian and His Age.—Twice a week; second semester. *One unit.* (Not given in 1947-1948.) Professor Perry.

125. Plato.—Twice a week; second semester. *One unit.* (Not given in 1947-1948.)

Courses for Graduates and Advanced Undergraduates

5. Herodotus and the Lyric Poets.—Three times a week; first semester. (Not given in 1947-1948.)

6. Thucydides and Plato.—Three times a week; second semester. (Not given in 1947-1948.)

7. Greek Drama: Tragedy and Comedy.—Three times a week; first semester. Professor Turyn.
8. Oratory and Aristotle.—Three times a week; second semester. Professor Turyn.
18. Greek Archaeology.—Twice a week; first semester. Dr. Lazenby.
54a-54b. Introduction to Comparative Literature.—See English 54a-54b.

LATIN

Preparation for first-year graduate work in Latin should include at least two years of preparatory Latin and three years of college Latin. A reading knowledge of French and German is important. Some acquaintance with Greek is highly desirable, and the study of history and philosophy is especially recommended.

Candidates for the degree of Master of Arts in the Teaching of Latin must earn four units in Latin, two units in education, and two units in electives. Requirements are Latin (at least two of the four units must be in courses numbered 100 or over; the other two units may be chosen in whole or in part from the following list: Latin 21, 22, 23, 24), 4 units; Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The course in Latin and the electives must be selected with the approval of the adviser. The electives may be in Latin, in education, or, in exceptional cases, in other fields.

Courses for Graduates

101. Latin Epigram.—Twice a week; first semester. *One unit.* (Not given in 1947-1948.)
102. Roman Oratory.—Twice a week; first semester. *One unit.* (Not given in 1947-1948.)
104. Latin Palaeography.—Twice a week; first semester. *One unit.* (Not given in 1947-1948.)
106. Terence.—Twice a week; first semester. *One unit.* (Not given in 1947-1948.)
107. Latin Epigraphy.—Twice a week; second semester. *One unit.* (Not given in 1947-1948.)
109. Vergil.—Twice a week; first semester. *One unit.* Professor Turyn.
110a-110b. Bibliography and Criticism.—Thesis course. Same as Greek 110a-110b. Once a week; both semesters. *One unit.* Associate Professor Oliver.
114. Caesar.—Twice a week; second semester. *One unit.* Professor Turyn.
115. Latin Elegy.—Twice a week; first semester. *One unit.* (Not given in 1947-1948.) Associate Professor Oliver.
116. Latin Satire.—Twice a week; second semester. *One unit.* (Not given in 1947-1948.)
118. Latin Romance.—Twice a week; first semester. *One unit.* (Not given in 1947-1948.) Professor Perry.
119. Suetonius.—Twice a week; second semester. *One unit.* (Not given in 1947-1948.) Associate Professor Oliver.
150. Cicero's Letters.—Twice a week; second semester. *One unit.* (Not given in 1947-1948.)
151. The Annales of Tacitus.—Twice a week; first semester. *One unit.* Associate Professor Oliver.

Courses for Graduates and Advanced Undergraduates

10. Latin Composition.—Twice a week; second semester.
21. Tacitus (*Annales*) and Juvenal.—Three times a week; first semester. (Not given in 1947-1948.)

22. Martial, Suetonius, and Apuleius.—Three times a week; second semester. (Not given in 1947-1948.)
23. Livy, Tibullus, and Propertius.—Three times a week; first semester.
24. Ovid (*Elegy*) and Seneca (*Epistles and Tragedies*).—Three times a week; second semester.

54a-54b. Introduction to Comparative Literature.—See English 54a-54b.

COMMERCE

Candidates for the degree of Master of Science in Commercial Teaching must earn credit as specified below.

(1) *Economics.*—A sufficient number of hours in approved advanced undergraduate and graduate courses in economics must be taken to bring the total credit hours in this subject to not less than 17 for the five years.

(2) *Business Organization and Operation.*—A sufficient number of hours in approved advanced undergraduate and graduate courses in business organization and operation must be taken to bring the total credit hours in this group of subjects to not less than 17 for the five years, including business law and excluding Business Organization and Operation 5.

(3) *Accountancy.*—A sufficient number of hours in approved advanced undergraduate and graduate courses in accountancy must be taken to bring the total credit hours in this subject to not less than 17 for the five years, excluding Accountancy S15.

(4) *Education.*—Education 101 or 30, and 125.

(5) *Commerce.*—Sufficient work must be taken in the fifth year in courses recognized for graduate credit to bring the total hours in commerce courses to not less than 60 for the five years.

(6) *Electives.*—Nine hours of approved advanced undergraduate and graduate courses having general educational value, and of courses which bear directly on subjects taught in high schools.

(7) *Summary.*—The requirements of 1-5, above, can be satisfied with a minimum of 23 hours of credit; with the 9 hours of electives (6), this makes a total of 32 hours in the fifth year, or 162 hours for the five-year program.

The maximum *required* credit hours for electives during the third, fourth, and fifth years in Commerce fields are as follows: business organization and operation (including business law), 6 hours; economics, 9 hours; accountancy, 5 hours.

DAIRY HUSBANDRY

Dairy husbandry may be elected as a major subject for the Master of Science or Doctor of Philosophy degree. For either degree, a first minor must be taken outside the department, preferably outside the college; if a second minor is elected, it may be chosen in the department.

Candidates for advanced degrees in dairy husbandry must have had adequate undergraduate training in dairy husbandry, and should have had courses in the following subjects, depending on the field of specialization: chemistry, bacteriology, physics, economics, zoology, genetics, and mathematics.

Courses for Graduates

101. Economic Milk Production.—Twice a week; both semesters. *One-half to two units.* Professor Yapp.
105. Dairy Manufactures.—Twice a week; both semesters. *One-half to two units.* Professors Ruehe, Tracy, Herreid, Associate Professor Tuckey.
106. Dairy Bacteriology.—Assigned problems. Both semesters. *One-half to two units.* Professor Hussong.
107. Dairy Chemistry.—Assigned problems. Both semesters. *One-half to two units.* Professor Overman.
108. Physiology of Lactation.—Twice a week; both semesters. *One-half to two units.* Professor Gaines.
112. Research.—Graduate students writing theses should so indicate when registering. Both semesters. *One-half to four units.* Work may be taken in the following subjects:
   (a) Dairy Bacteriology.—Professor Hussong.
   (b) Dairy Chemistry.—Professor Overman.
   (c) Dairy Cattle Breeding.—Professor Yapp.
   (d) Dairy Cattle Feeding.—Professor Nevens.
   (e) Milk Production.—Professor Gaines.
   (f) Dairy Manufactures.—Professors Ruehe, Tracy, Herreid, Associate Professor Tuckey.
113. Seminar.—Current literature in dairy bacteriology, dairy chemistry, and dairy manufactures. Once a week; both semesters. *One-half unit.* Members of the graduate staff.
114. Seminar.—Current literature relating to various phases of milk production. Once a week; both semesters. *One-half unit.* Professors Gaines, Yapp, Nevens.
115. Principles of Dairy Technology.—An advanced study of the fundamental problems involved in the processing of milk and milk products. Twice a week; first semester. *One unit.* Professor Herreid.

Courses for Graduates and Advanced Undergraduates

4. Ice Cream Manufacture.—Twice a week; first semester. Professor Tracy.
5. Composition of Dairy Products.—Three times a week; first semester. Professor Overman.
7. Creamery Buttermaking and Factory Management.—Twice a week; second semester. Professor Ruehe.
8. Fluid Milk Plant Operations.—Twice a week; second semester. Professor Herreid.
10. Advanced Dairy Bacteriology.—Three times a week; first semester. Professor Hussong.
14. Milk Condensing.—Twice a week; second semester. Professor Tracy.
17. Advanced Study of Dairy Breeds.—Three times a week; second semester. Professor Yapp.
20. Problems in Dairy Farming.—Three times a week; first semester. Professor Yapp.
22. Cheese Manufacture.—Twice a week; first semester. Associate Professor Tuckey.
25. Advanced Study of Dairy Cattle Feeding.—Twice a week; second semester. Professor Nevens.
32. Plant Management.—Twice a week; second semester. Professor Tracy.

ECONOMICS

Students who wish to make economics their major subject for an advanced degree must have had at least twenty-seven hours of undergraduate work in social science, fifteen of which must have been in economics; the work in economics must include a course in principles of economics, a course in statistics,

and other courses for which the course in principles is a prerequisite. Students in other departments who wish to take a minor in economics must have had at least twelve hours in social science, eight hours of which must have been in economics, consisting of a course in principles of economics and other courses for which the course in principles is a prerequisite. Students who can not meet these requirements may register for graduate work but, unless specially exempted for reasons satisfactory to the adviser in charge, must remove any deficiencies during the first year of residence by taking prescribed courses without graduate credit.

A first-year student whose major is economics must take either Economics 101 or 103 throughout the year. If a minor is taken outside the department, two units of work will ordinarily be required. Undergraduate courses that are approved for graduate credit may be taken in lieu of graduate courses but not to exceed a total credit of two units.

A student who wishes to become a candidate for the Doctor of Philosophy degree with a major in economics must pass a preliminary examination showing: (1) a detailed knowledge of economic theory and its history; (2) a detailed knowledge of certain special fields of economics or allied fields, the number and selection of which is to be determined by the adviser in consultation with the student; and (3) a general acquaintance with the subject matter and bibliography of other branches of economics. In the work offered in some related field outside the department the student will be expected to satisfy the examiners as to his proficiency in that subject.

A student who chooses economics as a minor for the Doctor of Philosophy degree must take at least two units of work in the department.

Courses for Graduates

101. Economic Theory.—For students whose minor is economics and other students who have had only the minimum preparation for graduate study in economics. Twice a week; both semesters. *One unit.* Assistant Professor Flanders.
102. Monetary Theory and History.—Twice a week; both semesters. *One unit.* Associate Professor Nolen.
103. Economic Theory.—For students whose major is economics and others who have had a thorough training in economics. Twice a week; both semesters. *One unit.* Professor Blodgett.
104a. Theories and Policies of International Commerce.—Twice a week; first semester. *One unit.* Assistant Professor Beckett.
104b. Theories and Policies of International Trade.—Twice a week; second semester. *One unit.* Assistant Professor Beckett.
105. Public Finance.—Twice a week; both semesters. *One unit.* Professor Hunter.
109. Theory and Practice of Central Banks.—Twice a week; both semesters. *One unit.* (Not given in 1947-1948.) Professor Lee.
110. Corporation Finance.—Twice a week; both semesters. *One unit.* Associate Professor Van Arsdell.
112. Labor Economics.—Twice a week; both semesters. *One unit.* Associate Professor McNatt.
118. Seminar.—For students writing theses. Both semesters. *One-half to four units.* For students writing doctor's theses, Professor Blodgett; for students writing master's theses, Assistant Professor Flanders.
120. History of Economic Thought.—Twice a week; both semesters. *One unit.* Professor Bell.
122. Economic History of the United States.—Twice a week; both semesters. *One unit.* Associate Professor Kemmerer.

123. Industrial and Financial Organization of Society.—Twice a week; both semesters. *One unit.* (Not given in 1947-1948.) Professor Lee.
136. Investments.—Twice a week; both semesters. *One unit.* Professor Brown.
140. Comparative Economic Systems.—Twice a week; first semester. (Not given in 1947-1948.) *One unit.* Professor Blodgett.
165. Social Control of Business.—Twice a week; both semesters. *One unit.* Associate Professor Steiner.
170. Economic Statistics.—Twice a week; both semesters. *One unit.* Professor Neiswanger.
192. Economics of Transportation.—Twice a week; both semesters. *One unit.* Professor Locklin.

Courses for Graduates and Advanced Undergraduates

3. Money, Credit, and Banking.—Three times a week; both semesters. Associate Professor Nolen.
5. Financial History of the United States.—Three times a week; first semester. Associate Professor Nolen.
6. Principles and Practices of Investment Banking.—Three times a week; first semester.
8. Money, Prices, and Foreign Exchange.—Three times a week; second semester. Associate Professor Nolen.
9. Comparative Banking Systems and Practices.—Three times a week; second semester. Professor Lee.
10. Corporation Finance and Management.—Three times a week; both semesters. Associate Professor Van Arsdell.
11. Industrial Consolidation.—Three times a week; both semesters. Professor Brown.
15. Consumer Economics.—Three times a week; both semesters. Professor Jordan.
19. Economic Development of the United States before 1860.—Three times a week; first semester. Associate Professor Kemmerer.
20. Economic Development of the United States since 1860.—Three times a week; second semester. Associate Professor Kemmerer.
23. Current Economic Problems (National and International).—Three times a week; both semesters.
24. Economic Development of Modern Europe, I.—Three times a week; first semester. Assistant Professor Hammond.
25. Economic Development of Modern Europe, II.—Three times a week; second semester. Assistant Professor Hammond.
29. Foreign Commerce and Commercial Policies.—Three times a week; both semesters.
30. World Markets.—Three times a week; second semester. Assistant Professor Beckett.
31. Organization of International Commerce.—Three times a week; both semesters.
36. Investments.—Three times a week; both semesters. Associate Professor Mayer.
39. Economics of Social Security.—Three times a week; both semesters. Associate Professor McNatt.
40. Labor and the Law.—Three times a week; both semesters. Associate Professor McNatt.
41. Labor Problems.—Three times a week; both semesters. Associate Professor McNatt.
42. Trade Unionism.—Three times a week; both semesters. Associate Professor McNatt.
43. Personnel Administration.—Three times a week; both semesters. Assistant Professor Robb.
44. Comparative Economic Systems.—Three times a week; both semesters. Professor Blodgett.
51. Public Finance.—Three times a week; both semesters. Professor Hunter.
52. Fiscal System of Illinois.—Three times a week; both semesters. Professor Allen.

54. Economics of Insurance.—Three times a week; both semesters.
55. Life Insurance.—Three times a week; both semesters.
56. Property Insurance.—Three times a week; both semesters.
61. Economic Theory.—Three times a week; both semesters. Professor Bell.
62. History of Economic Thought.—Three times a week; both semesters. Professor Bell.
65. Social Control of Business.—Three times a week; both semesters. Associate Professor Steiner.
71. Business Statistics.—Three times a week; both semesters. Assistant Professor Haworth.
72. Business Barometrics.—Three times a week; both semesters.
81. Economics of Public Utilities.—Three times a week; both semesters. Associate Professor Mayer.
83. Public Utility Rates.—Three times a week; second semester. (Not given in 1947-1948.) Professor Gray.
92. Economics of Transportation.—Three times a week; both semesters. Professor Locklin.
93. Industrial Traffic Management.—Three times a week; second semester. Professor Locklin.
95. Economic Problems of Air Transportation.—Three times a week; both semesters. Professor Locklin.
96. Current Transportation Problems.—Three times a week; second semester. Professor Locklin.

EDUCATION

In addition to complying with the general rules of the Graduate School, candidates for the degree of Master of Arts or Master of Science in Education must meet the following requirements: (1) Students who began their graduate work in the summer of 1941, or thereafter, must select and follow an approved curriculum and consult with a designated adviser for that curriculum in planning their programs. (2) Education 6 and 25, or their equivalents, are prerequisites for all graduate courses. (3) Education 125 is a required course for all students. (4) For students who began their graduate work prior to the summer of 1940 and have not taken an undergraduate or graduate course in the history of education, Education 11 or 30 is required. Those who began their work under this requirement may elect to finish under the following requirement. (5) For all students who began their graduate work in the summer of 1940, or thereafter, there is required a graduate course in either the history of education or the philosophy of education.

Programs leading to the professional degrees of Master of Education (Ed.M.) and Doctor of Education (Ed.D.) are offered as stated on page 16. A minimum of two years of approved professional experience and the completion of the requirements for the degree of Master of Arts or Master of Science, or the equivalent, is required for admission to the curriculum leading to the degree of Master of Education. In addition, the candidate must be recommended by the college committee on admission of graduate students in education as showing promise of superior professional competence. One year of graduate study (8 units) is required for the degree. The requirements for the degree of Doctor of Education include: (1) graduate residence equivalent to two full years beyond the degree of Master of Arts or Master of Science (one full year beyond the degree of Master of Education), and (2) a field study or other type of professional investigation. In a typical case the candidate who is employed in professional work during the school year will devote a minimum of three summer sessions and two academic years to the field study or the professional investigation.

For the requirements for the degree of Doctor of Philosophy, see page 17.

Information concerning extramural graduate courses in education may be obtained from the Dean of the Division of University Extension.

Courses for Graduates

101. PHILOSOPHY OF EDUCATION.—Once a week; two hours; both semesters. *One unit.* Professor BROWNE, Assistant Professor STANLEY.
102. RESEARCH IN THE HISTORY OF EDUCATION.—Arrange; both semesters. *One unit.*
103. LEGAL BASIS OF SCHOOL ADMINISTRATION.—Once a week; two hours; second semester. *One unit.* Associate Professor SUMPTION.
104. EDUCATIONAL ADMINISTRATION.—Once a week; two hours; first semester. *One unit.* Professor WEBER.
105. ELEMENTARY SCHOOL ORGANIZATION AND ADMINISTRATION.—Once a week; two hours; first semester. *One unit.* Associate Professor SHORES.
106. ADMINISTRATION OF JUNIOR AND SENIOR HIGH SCHOOLS.—Once a week; two hours; first semester. *One unit.* Associate Professor TRUMP.
109. PSYCHOLOGY OF ADOLESCENCE FOR TEACHERS.—Once a week; two hours; both semesters. *One unit.* Associate Professor BLAIR.
110. RECENT RESEARCH IN THE TEACHING OF HIGH SCHOOL SUBJECTS.—Once a week; two hours; first semester. *One unit.*
112. SUPERVISION IN HOME ECONOMICS EDUCATION.—Once a week; two hours; first semester. *One unit.* Associate Professor WALSH.
114. CURRICULUM PROBLEMS AND TRENDS IN HOME ECONOMICS EDUCATION.—Once a week; two hours; first semester. *One unit.* Associate Professor WALSH.
115. EDUCATION AND THE PROBLEMS OF PERSONALITY.—Once a week; two hours; second semester. *One unit.* No credit is allowed to students who have credit in Education 118. Assistant Professor REAGAN.
116. SEMINAR IN HOME ECONOMICS EDUCATION.—Once a week; two hours; second semester. *One unit.* Associate Professor WALSH.
119. TRENDS AND TECHNIQUES IN CURRICULUM MAKING.—Once a week; two hours; first semester. *One unit.* Professor SMITH.
120. SUPERVISION OF JUNIOR AND SENIOR HIGH SCHOOLS.—Once a week; two hours; second semester. *One unit.* Associate Professor TRUMP.
121. EDUCATIONAL MEASUREMENTS.—Once a week; two hours; both semesters. *One unit.* Professor ODELL.
122. EDUCATIONAL AND VOCATIONAL GUIDANCE.—Once a week; two hours; both semesters. *One unit.* Associate Professor FINCH.
123. EDUCATIONAL STATISTICS.—Once a week; two hours; both semesters. *One unit.* Professor ODELL.
124. TECHNIQUES IN EDUCATIONAL RESEARCH.—Once a week; two hours; second semester. *One unit.* Professor MONROE.
125. ADVANCED EDUCATIONAL PSYCHOLOGY.—Once a week; two hours; both semesters. *One unit.* Professor POTTHOFF, Associate Professors BLAIR, SIMPSON.
127. CURRICULAR DEVELOPMENT IN SECONDARY SCHOOLS.—Once a week; two hours; second semester. One unit. Professor HAND.
129. JUNIOR COLLEGE.—Once a week; two hours; second semester. *One unit.* Professor WEBER.
134. CURRICULUM PROBLEMS AND TRENDS IN ELEMENTARY SCHOOL READING AND THE LANGUAGE ARTS.—Once a week; two hours; second semester. *One unit.* Associate Professor SHORES.
135. CURRICULUM PROBLEMS AND TRENDS IN ELEMENTARY SCHOOL SOCIAL STUDIES. —Once a week; two hours; first semester. *One unit.* Professor REEDER.
136. DIAGNOSTIC AND REMEDIAL PROGRAMS OF THE SCHOOL.—Once a week; two hours; both semesters. *One unit.* Professor KIRK, Associate Professor DOLCH.
138. SUPERVISION OF THE ELEMENTARY SCHOOL.—Once a week; two hours; second semester. *One unit.* Professor REEDER.

139. Seminar in Curriculum Problems.—Once a week; two hours; second semester. *One unit.* Professor Smith.
150. Thesis.—Both semesters. *One-half to two units.* Professor Spalding and others.
170. Public School Finance and Business Administration.—Once a week; two hours; second semester. *One unit.* Professor Weber.
175. The High School Program of Agricultural Education.—Once a week; two hours; second semester. *One unit.* (Not given in 1947-1948.) Professor Hamlin.
176. Vocational Education in Agriculture for Adults.—Once a week; two hours; first semester. *One unit.* Professor Hamlin.
177. The Community Program of Agricultural Education.—Once a week; two hours; second semester. *One unit.* Professor Hamlin.
178. Seminar in Agricultural Education.—Biweekly; first semester. *One-half unit.* Professor Hamlin.
180. Seminar in Elementary Education.—Once a week; two hours; second semester. *One unit.* Professor Reeder.
184. Seminar in School Administration.—Once a week; two hours; second semester. *One unit.* Professor Weber.
185. Seminar in Educational Psychology.—Arrange; both semesters. *One unit.* Professor Potthoff, Associate Professors Finch, Dolch, Blair.
186. Seminar in Secondary Education.—Once a week; two hours; both semesters. *One unit.* Professor Hand.
187. Seminar in Industrial Education and Guidance.—Once a week; two hours; first semester. *One unit.* Professor Mays.
188. Curriculum Problems and Trends in Industrial Education.—Once a week; two hours; first semester. *One unit.* Professor Mays.
189. Administration and Supervision of Industrial Education.—Once a week; two hours; second semester. *One unit.* Professor Mays.
190. Research in Education.—Arrange; both semesters. *One unit.* Professor Spalding and others.
192. The American College.—Once a week; two hours; second semester. *One unit.* Professor Benner.
200. Education and the Individual.—Open only to students who have been admitted to candidacy for the degrees of Ed.M. or Ed.D. and by special permission to approved advanced students who are candidates for the degree of Ph.D. in education. Once a week; first semester. *One unit.* Professor Potthoff, Associate Professors Finch, Blair.
201a-201b. The School and Society.—Open only to students who have been admitted to candidacy for the degrees of Ed.M. or Ed.D. and by special permission to approved advanced students who are candidates for the degree of Ph.D. in education. Once a week; first semester. *One unit.* Professor Smith, Associate Professor Shores, Assistant Professors Anderson, Stanley.
251. Advanced Seminar for Third-Year Graduate Students.—Both semesters. No credit. Associate Professor Finch and others.

Courses for Graduates and Advanced Undergraduates

11. Ancient and Medieval Education.—Twice a week; second semester. (Not given in 1947-1948.)
18. Educational Measurements.—Three times a week; first semester. Professor Odell.
30. History of American Education.—Once a week; two hours; both semesters. Assistant Professor Anderson.
41. Principles of Vocational Education.—Three times a week; both semesters. Professor Mays.
42a. Education of Handicapped Children.—Three times a week; second semester. Professor Kirk.
43. Mental Tests.—Three times a week; second semester. (Not given in 1947-1948.) Professor Odell.
44a. Education of the Hard of Hearing.—Three times a week; second semester. Miss Quinn.

46a. Curricular Development in Elementary Schools.—Once a week; second semester. (Not given in 1947-1948.) Associate Professor Dolch.
46b. Special Problems in Elementary Curriculum.—Once a week; second semester. Associate Professor Dolch.
47a. Development of Teaching Units in the Elementary School.—Two times a week; first semester. Associate Professor Shores.
47b. Special Problems in Elementary Teaching.—Two times a week; first semester. Associate Professor Shores.
50. Child Psychology.—Three times a week; second semester. (Not given in 1947-1948.)
52. Part-Time and Evening Schools.—Three times a week; first semester. (Not given in 1947-1948.) Professor Mays.
53. Problems of Industrial Education.—Three times a week; second semester. Professor Mays.
55. Principles and Practices in Vocational Guidance.—Three times a week; both semesters. Professor Mays.
64. Child Development and Problems in Education.—Three times a week; both semesters. Assistant Professor Stendler.
66. Sociology of Education.—Same as Sociology 80. Three times a week; second semester. Professor Znaniecki.

ELECTRICAL ENGINEERING

Graduate work in electrical engineering is offered to graduates of electrical engineering curricula substantially equivalent to that of the University of Illinois in the option in which advanced work is desired. Graduates of curricula in the physical sciences and mathematics may also be admitted to advanced study if they have the necessary background to profit from graduate work in electrical engineering.

Courses for advanced undergraduates and graduates are also open for minor credit to students with a major in other departments who have the proper prerequisites.

Courses for Graduates

100. Graduate Seminar.—Both semesters. No credit. Professor Everitt.
110. Engineering Analysis.—Three times a week; both semesters. *One unit.* Associate Professor Bennett.
112. Advanced Engineering Measurements.—Three times a week; both semesters. *One unit.* Associate Professor Hayward.
113. Servomechanisms and Automatic Control Devices.—Three times a week; both semesters. *One unit.* Professor Fett.
120. Electromagnetic Waves and Radiating Systems.—Three times a week; both semesters. *One unit.* Professor Jordan.
121. Advanced Electromagnetic Engineering.—Three times a week; both semesters. *One unit.* Professor Jordan.
122. Advanced Communication Networks.—Three times a week; both semesters. *One unit.* Professor Everitt.
123. Electron and Ion Dynamics.—Three times a week; both semesters. *One unit.* Professor Samuel.
124. Theory of Gaseous Discharge Devices.—Three times a week; both semesters. *One unit.* Professor Fett.
125. Photoelectric and Thermionic Phenomena.—Three times a week; both semesters. *One unit.* Associate Professor Bennett.
126. Electroacoustical Systems.—Three times a week; both semesters. *One unit.* Professor DeVore.
127. Boundary Value Problems.—Three times a week; both semesters. *One unit.* Professor DeVore.
128. Oscillations in Non-Linear Systems.—Three times a week; both semesters. *One unit.* Professor DeVore.

129. Vacuum Tube Circuit Analysis.—Three times a week; both semesters. *One unit.* Professor Fett.
130. Gas Tube Circuit Analysis.—Three times a week; both semesters. *One unit.* Professor Rockwood.
131. Microwave Circuits.—Three times a week; both semesters. *One unit.* Professor Samuel.
140. Advanced Power Circuit Analysis I.—Three times a week; both semesters. *One unit.* Professor Knight.
141. Advanced Power Circuit Analysis II.—Three times a week; both semesters. *One unit.* Professor Knight.
142. Advanced Analysis of Alternating Current Machinery.—Three times a week; both semesters. *One unit.* Professor Keener.
143. Analysis of Dynamo Machines Under Transient Conditions.—Three times a week; both semesters. *One unit.* Professor Keener.
144. Advanced Power System Analysis.—Three times a week; both semesters. *One unit.* Professor Faucett.
145. Power System Transients and Stability.—Three times a week; both semesters. *One unit.* Professor Faucett.
146. Electrical Design (Apparatus).—Three times a week; both semesters. *One unit.* Associate Professor Archer.
147. Electrical Design (Power System).—Three times a week; both semesters. *One unit.* Professor Faucett.
160. Treatment of Experimental Illumination Data.—Three times a week; both semesters. *One unit.* Professor Kraehenbuehl.
161. Methods of Illumination Calculations.—Three times a week; both semesters. *One unit.* Professor Kraehenbuehl.
162. Colorimetry in Illumination.—Three times a week; both semesters. *One unit.* Professor Kraehenbuehl.
163. Analytical Treatment of Light in Enclosures.—Three times a week; both semesters. *One unit.* Professor Kraehenbuehl.
164. Advanced Illumination Design.—Three times a week; both semesters. *One unit.* Professor Kraehenbuehl.
198. Special Problems.—Both semesters. *One-half to two units.* Department staff.
199. Research.—Both semesters. *One-half to three units.* Professors Everitt, Tykociner, Knight, Kraehenbuehl, Keener, Faucett, Samuel, Jordan, Fett, DeVore, Rockwood, Associate Professors Archer, Hayward, Skroder, Bennett.

Courses for Graduates and Advanced Undergraduates

11a. Direct and Alternating Current Circuits.—Not open for credit to students with majors in electrical engineering. No credit without Electrical Engineering 11b. Three times a week; both semesters.
11b. Direct and Alternating Current Laboratory.—No credit without Electrical Engineering 11a. Once a week; both semesters.
12a. Direct and Alternating Current Apparatus.—Not open for credit to students with majors in electrical engineering. No credit without Electrical Engineering 12b. Three times a week; both semesters.
12b. Direct and Alternating Current Laboratory.—No credit without Electrical Engineering 12a. Once a week; both semesters.
30a. Introduction to Circuit Analysis.—Not open for credit to students with majors in electrical engineering. No credit without Electrical Engineering 30b. Five times a week; both semesters.
30b. Circuits Laboratory.—No credit without Electrical Engineering 30a. Twice a week; both semesters.
32a. Electrical Machinery.—Five times a week; both semesters.
32b. Electrical Machinery Laboratory.—Three times a week; both semesters.
35a. Alternating Current Apparatus I.—Five times a week; both semesters.
35b. Alternating Current Apparatus Laboratory.—Twice a week; both semesters.
39a. Elements of Illuminating Engineering Design.—Three times a week; both semesters.

40a. Electronics.—Three times a week; both semesters.
40b. Electronics Laboratory.—Once a week; both semesters.
48a. Communication Networks and Lines.—Three times a week; both semesters.
48b. Communication Networks and Lines Laboratory.—Once a week; both semesters.
50a. Alternating Current Apparatus II.—Three times a week; both semesters.
50b. Alternating Current Apparatus Laboratory.—Twice a week; both semesters.
53a. Direct Current Apparatus.—Four times a week; both semesters.
53b. Electrical Dynamo Laboratory.—Twice a week; both semesters.
55c. Electrical Design.—Three times a week; both semesters.
57a. Principles of Illuminating Engineering.—Five times a week; both semesters.
57b. Illumination and Photometry Laboratory.—Once a week; both semesters.
58a. Illumination Design and Economics.—Four times a week; both semesters.
58b. Illumination Design Laboratory.—Twice a week; both semesters.
59a. Illumination Sources.—Three times a week; both semesters.
60a. Electronics.—Five times a week; both semesters.
60b. Electronics Laboratory.—Once a week; both semesters.
61a. Communication Engineering I.—Three times a week; both semesters.
61b. Communication Engineering Laboratory.—Once a week; both semesters.
62a. Electronics.—Three times a week; both semesters.
62b. Electronics Laboratory.—Once a week; both semesters.
63a. Communication Engineering II.—Three times a week; both semesters.
63b. Communication Engineering Laboratory.—Once a week; both semesters.
64c. Communication Design.—Three times a week; both semesters.
73a. Electrical Energy Measurements and System Protection.—Three times a week; both semesters.
73b. Energy Measurement and Protection Laboratory.—Once a week; both semesters.
74a. Power Transmission and Distribution Circuits.—Three times a week; both semesters.
85a. Fundamentals of Power Transmission Engineering.—Three times a week; both semesters.
86a. Illuminating Engineering.—Three times a week; both semesters.

ENGLISH LANGUAGE AND LITERATURE

(Including Rhetoric)

Students who enter graduate work with English as their major subject are required to give evidence of their ability to write good English. They must present the equivalent of fourteen hours of undergraduate work in English literature, the required college work in rhetoric, and the equivalent of four semesters of college work in Latin, or Greek, or French, or German. After the first year of graduate work a knowledge of French and German is indispensable.

Students making English their minor may be admitted to such courses as in the judgment of the instructor in charge they are qualified to pursue.

Degree of Master of Arts in English.—In addition to complying with the general rules of the Graduate School, candidates for the degree of Master of Arts in English must comply with the following rules of the Department of English: (1) They must choose most of their work from the group of courses described as "for graduates," and (2) must pass a general examination.

This is a three-hour written examination based upon the knowledge of English and American literature which an undergraduate English major may

be reasonably expected to have acquired. It must be taken during the student's first term of residence. All students failing to pass the examination during their respective first terms in residence are required to present a total of nine units for that degree, including one unit earned here in a survey course or in such other course as the Committee on Masters' Examinations may determine to be most needed. As a guide to the prospective students, it is suggested that the following undergraduate courses, or their equivalent, will best fit the pattern of the examination: (1) a reading course in ten plays of Shakespeare; (2) a course in one other major writer; (3) a course in a period of literature (e.g., the Renaissance, or the Romantic Period); (4) a survey of English literature.

Degree of Doctor of Philosophy in English. — Candidates for the degree of Doctor of Philosophy in English may expect to be examined on the entire field of the English language and literature. Candidates with literature as a major will take philology as a first minor. They are urged, furthermore, to acquaint themselves as fully as possible with the history and philosophy of the period in which their main interest lies, and with the foreign languages and literature most closely related to English and that period.

Degree of Master of Arts in the Teaching of English. — Candidates for the degree of Master of Arts in the Teaching of English must earn four units in English, two units in education, and two units in electives. Requirements are English, 4 units (candidates for junior college teaching should take Rhetoric 105); Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The courses in English and the electives must be selected with the approval of the adviser. The electives may be in English, in education, or, in exceptional cases, in other fields.

Courses for Graduates

101. Research in Special Topics.—Both semesters. *One to two units.* Professors Larsen, Fletcher, Baldwin, Parry, Landis, Secord, Herrick, Ray, Smith, Associate Professors Gettmann, Roberts, Glenn, Goldman, Assistant Professors Wasserman, Shattuck, Evans, Stillwell.

108. Old English (Anglo-Saxon).—Three times a week; first semester. *One unit.* Professor Smith.

109. Old English (Anglo-Saxon).—Beowulf. Three times a week; second semester. *One unit.* Professor Larsen.

112a-112b. Chaucer and His Times.—Three times a week; both semesters. *One unit.* Professor Smith.

125. Middle English.—Introduction to Middle English dialects with special emphasis on the East Midland. Twice a week; second semester. *One unit.* (Not given in 1947-1948.) Professor Larsen.

128a-128b. Literature of the Sixteenth Century.—Once a week; two hours; both semesters. *One unit.* Professor Baldwin.

129a-129b. English Literature from the Norman Conquest to 1400.—Twice a week; both semesters. *One unit.* Professor Parry.

130a-130b. Tragedy.—Twice a week; both semesters. *One unit.* (Not given in 1947-1948.)

138a-138b. The Romantic Movement.—Twice a week; both semesters. *One unit.* Associate Professor Gettmann.

139a-139b. Problems in American Literature and Cultural History.—Once a week; two hours; both semesters. *One unit.*

141a-141b. Literature of the Seventeenth Century.—Once a week; two hours; both semesters. *One unit.* Professor Fletcher.

143a-143b. SEMINAR IN THE HISTORY AND THEORY OF PROSE FICTION.—Once a week; two hours; both semesters. *One unit.* Associate Professor GETTMANN.

145a-145b. LITERATURE OF THE EIGHTEENTH CENTURY.—Once a week; two hours; both semesters. *One unit.* Professor SECORD.

146a-146b. SEMINAR IN MILTON AND HIS AGE.—Once a week; two hours; both semesters. *One unit.* Professor FLETCHER.

147a-147b. SHAKESPEARE AND ELIZABETHAN DRAMA.—Study of the chief plays. Three times a week; both semesters. *One unit.* Professor BALDWIN.

148. SEMINAR IN ELIZABETHAN DRAMA.—Twice a week; first semester. *One unit.* (Not given in 1947-1948.) Professor BALDWIN.

149a-149b. DEVELOPMENT OF TUDOR DRAMA.—Twice a week; both semesters. *One unit.* (Not given in 1947-1948.) Professor BALDWIN.

150a-150b. STUDIES IN VICTORIAN LITERATURE.—Once a week; two hours; both semesters. *One unit.* Professor RAY.

151a-151b. STUDIES IN THE HISTORY OF THE EIGHTEENTH CENTURY NOVEL.—Twice a week; both semesters. *One unit.* Professor SECORD.

157. SEMINAR IN SPENSER.—Twice a week; second semester. *One unit.* (Not given in 1947-1948.) Professor SMITH.

Courses for Graduates and Advanced Undergraduates

17. HISTORY OF THE ENGLISH LANGUAGE.—Three times a week; first semester. Professor SMITH.

25. CHAUCER.—Three times a week; first semester. Assistant Professor STILLWELL.

26. SPENSER.—Three times a week; second semester. Professor SMITH, Associate Professor GOLDMAN.

35. ENGLISH DRAMA (PREVIOUS TO SHAKESPEARE).—From the beginning to 1600. Three times a week; first semester. (Not given in 1947-1948.) Professor BALDWIN.

36. ENGLISH DRAMA (EXCLUSIVE OF SHAKESPEARE).—From 1600 to 1700. Three times a week; second semester.

38. DEVELOPMENT OF ARTHURIAN ROMANCE.—Three times a week; second semester. (Not given in 1947-1948.) Professor PARRY.

53. STUDIES IN MIDDLEWESTERN LITERATURE.—A survey of middlewestern literature from 1825 to Dreiser, with special emphasis on the development of realism in poetry and fiction. Three times a week; first semester. Associate Professor FLANAGAN.

54a-54b. INTRODUCTION TO COMPARATIVE LITERATURE.—Three times a week; both semesters. Professors PARRY, LANDIS, HAMILTON, REHDER, Assistant Professors JACOB, HOLADAY.

55a-55b. SURVEY OF ENGLISH LITERATURE.—Three times a week; both semesters. Professor PARRY, Assistant Professor WASSERMAN.

63. POETRY OF MILTON.—Three times a week; second semester. Professor FLETCHER.

65a-65b. HISTORY AND PRINCIPLES OF LITERARY CRITICISM.—A study of the leading literary critics, ancient and modern, with emphasis upon the English. Three times a week; both semesters. Professor HERRICK.

66. ROMANTICISM.—The artistic and intellectual characteristics of eighteenth and nineteenth century romantic literature. Three times a week; second semester. Assistant Professor WASSERMAN.

RHETORIC

Courses for Graduates

105. THE THEORY AND PRACTICE OF ENGLISH COMPOSITION.—An examination of modern prose style and a consideration of problems confronting writers and teachers of writing at the college level. Twice a week; both semesters. *One unit.* Associate Professor ROBERTS.

ENTOMOLOGY

The prerequisite for graduate work in entomology is two years of undergraduate biology, including zoology and entomology. A student who chooses entomology as a major for an advanced degree must have had at least six hours of undergraduate courses in entomology. A reading knowledge of French or German is required by the beginning of the second year.

Courses for Graduates

100. Research.—Once or twice a week; both semesters. *One-half to four units.*
   (a) Morphology and Embryology of Insects.—Professor Hayes.
   (b) Economic Entomology.—Professor Hayes, Associate Professor Kearns, Assistant Professor Horsfall.
   (c) Systematic Entomology.—Professor Balduf, Assistant Professor Ross.
   (d) Biology and Ecology of Insects.—Professors Hayes, Balduf, Assisttant Professor Horsfall.

107a-107b. Insect Anatomy.—Lectures and laboratory. Three times a week; both semesters. *One unit.* (Given in alternate years; not given in 1947-1948.) Professor Hayes.

Courses for Graduates and Advanced Undergraduates

6. Special Problems.—Once or twice a week; both semesters. Members of the department.

8b. Insect Pests of Field Crops.—Lectures and laboratory. Three times a week; second semester. (Given in alternate years; not given in 1947-1948.) Professor Hayes.

10a-10b. Morphology and Taxonomy of Immature Insects.—Lectures and laboratory. Three times a week; both semesters. (Given 1947-1948 and in alternate years.) Professor Hayes.

14. Medical and Veterinary Entomology.—Training in recognition, classification, methods of injury, habits and control or destruction of insects, mites, and ticks which are predators or parasites or disseminators of diseases among men and domestic animals. Twice a week; first semester. Assistant Professor Horsfall.

20. Insect Control.—Lectures and laboratory. Three times a week; first semester. Associate Professor Kearns.

21. Insect Bionomics.—Lectures and readings. Three times a week; second semester. (Given in 1947-1948 and in alternate years.) Assistant Professor Horsfall.

FRENCH

Students beginning graduate work for an advanced degree in French must have at least three years of college work in French, including one advanced literary course.

Students who have a knowledge of Latin and of Spanish or Italian, together with a reading knowledge of German, will find their work for an advanced degree greatly facilitated.

Candidates for the degree of Master of Arts in the Teaching of French must earn four units in French, two units in education, and two units in electives. Requirements are French 100a-100b, 2 units; Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The elective courses in French and the other electives must be selected with the approval of the adviser. The electives may be in French, in education, or, in exceptional cases, in other fields.

Courses for Graduates

100a-100b. Phonetics and Advanced Syntax.—Three times a week; both semesters. *One unit.* Professor Knudson.

101a-101b. Old French Literature.—Twice a week; both semesters. *One unit.* (Not given in 1947-1948.) Professor Knudson.

102a-102b. Villon, Rabelais, Montaigne, La Pléiade.—Twice a week; both semesters. *One unit.* (Not given in 1947-1948.)

103a-103b. Seventeenth Century Literature.—Twice a week; both semesters. *One unit.* (Not given in 1947-1948.)

104a-104b. Eighteenth Century Literature.—Twice a week; both semesters. *One unit.* Assistant Professor Smiley.

127a-127b. Nineteenth Century Literature to 1850.—Twice a week; both semesters. *One unit.* (Not given in 1947-1948.) Professor Jackson.

144a-144b. French Realism and Naturalism.—Twice a week; both semesters. *One unit.* Professor Jackson.

145a-145b. La Littérature Contemporaine.—(In French.) Twice a week; both semesters. *One unit.* (Not given in 1947-1948.) Assistant Professor Jacob.

175a-175b. History of the French Language.—Twice a week; both semesters. *One unit.* Professor Knudson.

195a-195b. Seminar.—Research work in special topics. Both semesters. *One to two units.* Professors Jackson, Knudson, Assistant Professors Jacob, Smiley.

Courses for Graduates and Advanced Undergraduates

10a-10b. Survey of French Literature.—Three times a week; both semesters. Professor Jackson.

17a-17b. Modern French Drama.—Twice a week; both semesters. Assistant Professor Viens.

24a-24b. French Drama of the Seventeenth and Eighteenth Centuries.—Three times a week; both semesters. Assistant Professor Kolb.

32a-32b. French Novel of the Nineteenth Century.—Three times a week; both semesters. Assistant Professor Jacob.

33a-33b. La Littérature Contemporaine.—(In French.) Twice a week; both semesters. Assistant Professor Jacob.

35a-35b. Civilisation Française.—(In French.) Twice a week; both semesters. (Not given in 1947-1948.)

GENETICS

Those desiring a general training in genetics may take a major or minor in botany or zoology. Those desiring to approach agricultural problems through genetics may take a major or minor in agronomy, horticulture, or animal science. For courses in the subject see departments of Agronomy, Animal Science, Botany, Horticulture, and Zoology and Physiology. An interdepartmental genetics seminar is held at 4 p.m. on the second, third, and fourth Mondays, in 107 Animal Genetics Building.

GEOGRAPHY

For graduate work in geography the student must have had at least the equivalent of an undergraduate major in geography. A major consists of twenty hours in geography, excluding Geography 1 or 1a, and including Geography 60a and at least five hours of other courses not open to freshmen. Candidates for a master's degree should obtain from the department a copy of special regulations governing a preliminary examination for transfer students and a comprehensive examination near the close of the second semester of residence for all candidates.

Candidates for the degree of Master of Science in the Teaching of Geography must earn four units in geography, two of which are electives, two units in education, and two units in electives. Requirements are Geography 134, 1 unit; Geography 135, 1 unit; Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The elective courses in geography and the other electives must be selected with the approval of the adviser. Two electives must be in geography, and the other two in geography, in education, or, in exceptional cases, in other fields.

Courses for Graduates

134. Advanced Studies in Geography.—Studies in geographical subjects. Both semesters. *One-half to four units.* Professor Blanchard, Associate Professors Page, Garland.
135. Research.—Once a week; both semesters. *One-half to four units.* Professor Blanchard, Associate Professors Page, Garland.

Courses for Graduates and Advanced Undergraduates

8. Geography of Europe.—Three times a week; second semester. Professor Blanchard.
11. Geography of Asia.—Three times a week; first semester. (Given in alternate years; not given in 1947-1948.)
14a. Climates of the Continents.—Three times a week; first semester. (Given in 1947-1948 and in alternate years.) Associate Professor Page.
53. Production of the Great World Staples.—Three times a week; first semester. (Given in 1947-1948 and in alternate years.) Professor Blanchard.
54. Advanced Commercial Geography.—Three times a week; first semester. (Given in alternate years; not given in 1947-1948.) Professor Blanchard.
60a-60b. Introduction to Research.—Two or more times a week; both semesters. Members of the department.

GEOLOGY

For graduate work in geology the student must usually have had at least an undergraduate major in geology and an acceptable field training. A major consists of twenty hours in geology, excluding Geology 1, 1a, 43, and 44, and including at least five hours of courses not open to freshmen or sophomores. The following undergraduate courses are recommended: Geology 2a, 6, 7, 9, 15, 16, 20, 24, and 33. Graduate students in other departments may nevertheless be admitted to certain graduate courses in geology. A candidate for a master's degree in geology must pass a general examination toward the close of the second semester of residence, covering the fields of geology as embraced in the courses listed above and in the graduate courses taken.

Courses for Graduates

102. Petrography.—Lectures and laboratory. Twice a week; both semesters. *One unit.* (Given in alternate years; not given in 1947-1948.)
125. Sedimentation.—Environments and processes of sedimentation; structures and textures of sediments. Three times a week; first semester. *One unit.* Professor Wanless.
126. Sedimentary Petrology.—Description of sedimentary rocks and cuttings; sampling rocks for analysis; various methods of analysis of sedimentary rocks and interpretation of results. Two or three times a week; second semester. *One unit.* Professor Wanless.

134. Advanced Studies in Geology.—Supervised individual study in metamorphism, pre-Cambrian geology, ore deposition, and other subjects. Both semesters. *One-half to two units.* Members of the department.
135. Research.—Once a week; both semesters. *One-half to four units.* Members of the department.
142. Stratigraphic Geology: Paleozoic.—Stratigraphic study of the formations with a consideration of characteristic fossils. Three times a week; first semester. *One unit.* Associate Professor Scott.
143. Stratigraphic Geology: Mesozoic and Cenozoic.—Stratigraphic study of the formations with a consideration of characteristic fossils. Three times a week; second semester. *One unit.* Associate Professor Scott.
145. Micropaleontology.—Classification of microorganisms: foraminifera, ostracodes, conodonts, scolecodonts, and other major groups. Stratigraphic correlation. Three times a week; both semesters. *One unit.* Associate Professor Scott.
151. Advanced Dynamic Geology.—A critical analysis of geologic processes and their results; the materials and structure of the earth; problems of geologic interpretations. Three times a week; first semester. *One unit.* (Given in 1947-1948 and in alternate years.) Professor Wanless.
152. Advanced Historical Geology.—Cosmogeny; the record of diastrophism; the development of the continents and oceans; the relationship between oceanic fluctuations and organic differentiation and evolution; physiographic, climatic, and organic history. Three times a week; second semester. *One unit.* (Given in 1947-1948 and in alternate years.) Professor Wanless.
160. Petroleum Geology.—Three times a week; both semesters. *One unit.* (Given in 1947-1948 and in alternate years.) Associate Professor Hough.

Courses for Graduates and Advanced Undergraduates

6. Optical Mineralogy.—Optical properties of minerals and use of the petrographic microscope. Emphasis on oil immersions. Designed for students in geology, ceramics, agriculture, chemistry, or physics. Three times a week; both semesters. Associate Professor Chapman.
7. Petrology.—Composition, structures, textures, origin, and classification of rocks. Studies of thin sections and hand specimens. Four times a week; second semester. Associate Professor Chapman.
9. Invertebrate Paleontology.—Fossil groups in biological sequence. Three times a week; first semester. Associate Professor Scott.
15. Structural Geology.—Rock deformation and its results. Three times a week; first semester. Associate Professor Chapman.
16. Stratigraphy.—Fossil faunas, with special reference to Paleozoic invertebrates, correlation, and stratigraphy. Three times a week; second semester. Associate Professor Scott.
17. Geomorphology.—Land forms and their origins. Three times a week; first semester. Professor White.
24. Field Methods.—Once a week and three or four one-day field trips and one longer field trip; second semester. Professor Wanless.
33. Geologic Maps.—Interpretation of topographic, geologic, and structural maps. Three times a week; first semester. Professor Wanless.
39. Geology of Illinois.—Stratigraphic and economic geology of Illinois. Three week-end field trips. Three times a week; first semester. (Given in alternate years; not given in 1947-1948.) Professor Wanless.
60a-60b. Introduction to Research.—Two or more times a week; both semesters. Members of the department.
61a-61b. Applied Petroleum Geology.—Primarily for students in the College of Engineering. Three times a week; both semesters. Associate Professor Hough.
95. Economic Geology (Nonmetallic).—The nature, occurrence, origin, and uses of coal, oil, building stones, and bedded deposits of economic importance. Three times a week; second semester. (Given in 1947-1948 and in alternate years.) Professor White.

96. Economic Geology (Metallic).—The nature, occurrence, and origin of metalliferous deposits; theories of ore deposition; factors controlling exploitation. Three times a week; first semester. (Given in alternate years; not given in 1947-1948.)

GERMAN

Students desiring to take German as a major should have completed a four-year course of undergraduate study in German corresponding to the four-year course at this University, and should be familiar with the principal works of the writers of the classical and modern periods of German literature, show a general knowledge of the history of German literature, and be able to follow lectures in the German language. Of collateral subjects, a reading knowledge of French is important and is required for advanced graduate work. Some acquaintance with Latin and with German history is highly desirable.

Candidates for the degree of Master of Arts in the Teaching of German must earn four units in German, two units in education, and two units in electives. Requirements are (1) German, 2 to 2½ units to be chosen from the following courses: German 19a, 19b, 20a, 20b, 26a, 26b, 31, 32; (2) 1½ to 2 units from German courses open only to graduates; (3) Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; and (4) Education 125, Advanced Educational Psychology, 1 unit. The electives must be selected with the approval of the adviser. The electives may be in German, in education, or, in exceptional cases, in other fields.

Courses for Graduates

101. Seminar in Methods of Literary Criticism.—Once a week; both semesters. *One unit.* Professor Rehder.
102. Thesis and Research in Special Topics.—Both semesters. *One-half to four units.* Professors Rehder, Geissendoerfer, Associate Professors Frey, Philippson, Assistant Professors Jehle, Penzl.
104. Gothic.—Grammar and literature. Twice a week; first semester. *One unit.*
105. Old High German.—Grammar and interpretation of the oldest literary documents. Twice a week; first semester. *One unit.* (Not given in 1947-1948.)
113. German Literature of the Middle Ages, 800-1400.—Three times a week; first semester. *One unit.* Associate Professor Philippson.
125. History of the German Language.—Twice a week; second semester. *One unit.* Assistant Professor Penzl.
127. German Romanticism.—Twice a week; second semester. *One unit.* Professor Geissendoerfer.
150. Seminar in German Literature.—Once a week; second semester. *One unit.* Professor Rehder.

Courses for Graduates and Advanced Undergraduates

19a. Goethe.—Study of Goethe's works with the exception of *Faust.* Twice a week; first semester. (Not given in 1947-1948.)
19b. Goethe's Faust.—Study of *Faust,* Parts I and II. Twice a week; second semester. (Not given in 1947-1948.)
20a. German Classics I.—Study of the works of Lessing, Herder, and Wieland. Twice a week; first semester. Professor Geissendoerfer.
20b. German Classics II.—Study of the works of Schiller, Kleist, Hoelderlin, and Jean Paul. Twice a week; second semester. Professor Geissendoerfer.
26a. German Literature to 1800.—Three times a week; first semester. Professor Rehder.

26b. German Literature since 1800.—Three times a week; second semester. Professor Rehder.
31. Middle High German.—Twice a week; first semester. Assistant Professor Penzl.
32. History of German Civilization.—Three times a week; second semester. (Not given in 1947-1948.) Assistant Professor Stegemeier.

HISTORY

Graduate work in history presupposes two years of college work in this subject, or sixteen semester hours, which should include courses in European and American history equivalent to History 1a-1b and 3a-3b. Linguistic preparation, especially in French and German, is important. For medieval history some knowledge of Latin is essential, and Spanish is useful for certain fields of American history.

Graduate courses in history at the University of Illinois are of three kinds: (1) information and guidance in general reading; (2) instruction in methodology, historiography, and bibliography (a part of this work, course 103, is required of all graduate students in history during their first year); (3) seminars for the study of special fields with a view to training in methods of historical criticism and research.

Graduate students have an opportunity to pursue research in connection with the Illinois Historical Survey, an organization carrying on systematic studies in the history of Illinois. Through the use of materials collected by this survey, graduate students in the department have been given useful training in the study of manuscript as well as of printed material.

The following statement regarding the specific requirements for higher degrees in history is subject to the general requirements of the Graduate School.

Degree of Master of Arts in History.—Each candidate for this degree ordinarily is required to pass a general written examination early in the year and is expected to devote special attention to two of the following fields: ancient history, medieval history of continental Europe, modern history of continental Europe, English history, American history, Latin-American history, the Near East, the Far East. All candidates are expected to have a general knowledge of historical method (see course 103), and a working knowledge of one foreign language, ordinarily French or German.

Degree of Doctor of Philosophy in History.—A candidate who selects history as his major subject should prepare himself for examination in any four of the following fields, stating the particular field in which he wishes to specialize and in which his thesis is to be written: ancient history, medieval history of continental Europe to 1300, continental Europe from 1300 to 1648, continental Europe and its dependencies since 1648, England and its dependencies, the United States, Latin America, the Near East, and the Far East. This enumeration of fields is not to be regarded as excluding the possibility of accepting others as may be determined by the department in individual cases.

A candidate for the doctorate in history may select as his first minor one of the divisions of the field of history listed above which is not offered as a part of his major. He should preferably, however, select his minors from subjects offered by other departments. The following list of suitable minors is intended to be suggestive rather than exhaustive or compulsory.

Political Science.—(Any two acceptable for a first minor; any one, for a

second minor.) 1. International law and diplomacy. 2. Modern government. 3. Municipal government. 4. Constitutional and administrative law and jurisprudence. 5. Political theory.

Economics and Sociology.—(Any two acceptable for a first minor; any one, for a second minor.) 1. Economic history. 2. Economic theory. 3. Public and private finance. 4. Social reform. 5. Principles of sociology.

Philosophy and Education.—(Any two acceptable for a first minor; any one, for a second minor.) 1. History of ancient and medieval philosophy. 2. History of modern philosophy. 3. History of education.

Literature.—Some division of the history of literature which may be either comparative literature of a limited period or the literature of a particular country for a more extended period as may be agreed upon in each case.

Courses for Graduates

101. Seminar in American History.—Investigation of selected topics. Once a week; two hours; second semester. *One unit.* Professor Randall.

102a-102b. Seminar in English History.—Once a week; two hours; both semesters. *One unit.* Semester I: The Decade 1540-1550. Semester II: The Later Period of Elizabeth's Reign, 1590-1603. Professor Dietz.

103. Historical Method.—Required of all candidates for an advanced degree in history who do not present evidence of similar training elsewhere. Twice a week; first semester. *One unit.* Associate Professor Werner.

104a-104b. Seminar in Modern History.—The Enlightenment. Once a week; two hours; both semesters. *One unit.* Associate Professor Stearns.

105. Research in Special Topics.—Guidance in writing theses for advanced degrees. Both semesters. *One to two units.* Professors Pease, Jones, Randall, Dietz, Swain, Rodkey, Shannon, Associate Professors Werner, Stearns, Nowell, Odegaard, Starr, Bestor, Assistant Professors Dunbar, Shay.

106a-106b. Seminar in Medieval History.—Once a week; two hours; both semesters. *One unit.* Semester I: An Introduction to Medieval Historians. Semester II: Medieval Struggles for Unity. Associate Professor Odegaard.

117a-117b. Social History of the United States, 1775-1890.—Once a week; two hours; both semesters. *One unit.* Professor Shannon.

122a-122b. History of the West.—An intensive study of the westward movement, 1740-1761. Once a week; two hours; both semesters. *One unit.* Professor Pease.

122c-122d. History of the West.—An intensive study of the westward movement, 1761-1778. Once a week; two hours; both semesters. *One unit.* (Not given in 1947-1948.) Professor Pease.

126. Seminar in Latin-American History.—Studies in the history of the ABC Powers and Mexico. Once a week; two hours; first semester. *One unit.* Associate Professor Nowell.

127. Seminar in Latin-American History.—Studies in the Revolutionary and Post-Revolutionary period. Once a week; two hours; second semester. *One unit.* Associate Professor Nowell.

138a-138b. History of France, 1515-1700.—Once a week; two hours; both semesters. *One unit.* Professor Jones.

150a-150b. Ancient Historians; Problems in Roman History.—Once a week; two hours; both semesters. *One unit.* Professor Swain.

Courses for Graduates and Advanced Undergraduates

14. American Colonies in the Seventeenth Century.—Three times a week; first semester. Associate Professor Werner.

16a-16b. Foundations of American Society, 1700-1789.—Three times a week; both semesters. Assistant Professor Dunbar.

17a-17b. Social and Economic Forces in the United States since 1800.—Three times a week; both semesters. Professor Shannon.
20. The South, Old and New.—Three times a week; second semester. Professor Randall.
21. History of the United States since 1877.—Three times a week; first semester. Associate Professor Bestor.
22a-22b. History of the West, 1634-1830.—Twice a week; both semesters. Professor Pease.
23a-23b. Foundations of European and American Democratic Institutions, 1603-1714.—Twice a week; both semesters. Professor Pease.
24. History of Illinois, 1809-1947.—Twice a week; first semester. Professor Pease.
25. The Civil War and Reconstruction.—Three times a week; first semester. Professor Shannon.
26. History of Latin America to 1824.—Three times a week; first semester. Associate Professor Nowell.
27. History of Latin America since 1824.—Three times a week; second semester. Associate Professor Nowell.
31a-31b. History of Modern Italy, 1700-1947.—Twice a week; both semesters. Assistant Professor Shay.
32a-32b. European History since 1870.—Three times a week; both semesters. Assistant Professor Shay.
34a-34b. Development of Modern Europe, 1648-1848.—Three times a week; both semesters. Associate Professor Stearns.
37a-37b. History of the Far East.—Twice a week; both semesters. Associate Professor Werner.
39a-39b.—Europe During the Renaissance and the Reformation.—Three times a week; both semesters. Professor Jones.
41. The Middle Ages.—Formation and development of the European states. Three times a week; first semester. Associate Professor Odegaard.
42. Medieval Civilization, Religious and Intellectual.—Three times a week; second semester. Associate Professor Odegaard.
44a-44b. Constitutional History of England.—Three times a week; both semesters. Professor Dietz.
46a-46b. Social and Economic History of England since 1750.—Three times a week; both semesters. (Not given in 1947-1948.) Professor Dietz.
47a-47b. History of England, 1377-1603.—Three times a week; both semesters. Professor Dietz.
55. History of the Ancient Greek States.—Three times a week; first semester. Professor Swain.
56. History of the Roman Republic.—Three times a week; first semester. Professor Swain.
57a. The Hellenistic World.—Three times a week; second semester. Professor Swain.
57b. The Roman Empire.—Three times a week; second semester. Professor Swain.
60. The United States in the First World War.—Three times a week; second semester. Professor Pease.
62a-62b. Political and Constitutional Development of the United States.—Three times a week; both semesters. (62a not given in 1947-1948.) Professor Randall.

HOME ECONOMICS

Students preparing to make home economics their major subject for a master's degree should complete the undergraduate curriculum in home economics, or should have equivalent training. The degree is designated as Master of Science or Master of Arts in Home Economics. The major work may be done in either one of three curricula, (1) general home economics, (2) foods and nutrition, or (3) household management.

Candidates for a master's degree in home economics with the major work in general home economics or home management are required to take some advanced courses in education, economics, psychology, or sociology. Candidates for a master's degree with the major work in foods and nutrition should comply with the requirements of that field of concentration as provided in the undergraduate curriculum, or should have had equivalent training. These candidates are required to take Chemistry 50, Biochemistry, or Chemistry 40-41, Physical Chemistry, in addition to graduate courses in home economics.

Graduate students who choose home economics as their minor for the degree of Doctor of Philosophy must have adequate preparation in home economics, and must complete three units for a first minor or two units for a second minor, in addition to credit offered for the master's degree. At least one unit must be taken in courses numbered above 100.

Candidates for the degree of Master of Science in Home Economics Education must earn 8 units as follows: 2 to 2½ units in home economics, 3½ to 4 units in education, and 2 units in electives. The requirements are (1) 2 to 2½ units in home economics chosen from courses in home management (Home Economics 24, 28, 57a-57b, 106), foods and nutrition (Home Economics 20, 33, 35, 49, 63), textiles and clothing (Home Economics 31, 43a-43b), child development and family relationships (Home Economics 57a-57b, 101, 106); (2) Education 125, Advanced Educational Psychology, 1 unit; (3) Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; (4) Education 116, Seminar in Home Economics Education, 1 unit; (5) Education 114, Current Problems and Trends in Home Economics Education, 1 unit, or Home Economics 9, Home Economics Extension (Adult Education), ½ unit. The elective courses must be selected with the approval of the adviser.

Courses for Graduates

101. Problems in Family Living.—Twice a week; first semester. *One unit.* Professor Perkins.
102. Research.—Both semesters. *One-half to three units.*
    (a) Nutrition.—Professor J. M. Smith and staff.
    (b) Foods.—Assistant Professor Van Duyne.
    (c) Family Relations.—Professor Perkins.
    (d) Child Development.—Professor Perkins.
    (e) Textiles and Clothing.—Assistant Professor King.
103. Seminar in Nutrition.—Once a week; first semester. *One-half unit.* Professor J. M. Smith.
105. Seminar in Foods.—Once a week; second semester. *One-half unit.* Assistant Professor Van Duyne.
106. Seminar in Household Management (Including Child Development and Family Relations).—Second semester. *One-half to one unit.*
    (a) Family Relations.—Professor Perkins.
    (b) Child Development.—Professor Perkins.
    (c) Administration.—Professor Bane.
107. Problems in Human Nutrition.—Second semester. (Not given in 1947-1948.) *One-half to one unit.* Professor J. M. Smith.

Courses for Graduates and Advanced Undergraduates

9. Home Economics Extension.—Three times a week; second semester. Professor Burns and staff.
20. Physical Growth and Nutrition.—Twice a week; first semester. Professor J. M. Smith.

24. Farm Home Planning in Relation to Function.—Twice a week; second semester. Professor Carter.
28. Organization and Management of the Home.—Twice a week; second semester.
31. Clothing.—Three times a week; second semester. Assistant Professors Brockway, Whitesel.
33. Diet in Disease.—Three times a week; both semesters. Associate Professor Barto.
35. Problems in Foods.—Three times a week; second semester. Professor J. M. Smith, Associate Professor Janssen.
39a-39b. Readings in Foods and Nutrition.—Once a week; both semesters. Professor J. M. Smith, Associate Professor Barto, Assistant Professor Van Duyne.
41. Problems in Nutrition.—Three to five times a week; both semesters. Professor J. M. Smith.
43a-43b. Problems in Textiles and Clothing.—Three times a week; both semesters. Assistant Professors Brockway, King, Whitesel.
48. Institution Dietaries and Administration.—Three times a week; second semester. Associate Professor E. E. Smith.
51. Textiles.—Three times a week; first semester. Assistant Professor King.
55. Fashion Analysis.—Three times a week; second semester. Assistant Professor Brockway.
57a-57b. Problems in Home Management.—Three times a week; both semesters.
(a) Family Relations.—Professor Perkins.
(b) Child Development.—Professor Perkins.
(c) Household Management.—Professor Bane, Assistant Professor Goodyear.
(d) Housing.—Professor Carter, Assistant Professor Goodyear.
63. Experimental Foods.—Three times a week; both semesters. Professor J. M. Smith, Associate Professor Janssen.
66. Advanced Problems in Home Guidance of Children.—Three times a week; second semester. Professor Perkins.

HORTICULTURE

Graduate work is offered in the Department of Horticulture leading to the Master of Science and Doctor of Philosophy degrees. Candidates may specialize for either degree in floriculture, plant pathology, pomology, or vegetable crops.

Twenty hours of undergraduate work in horticulture and allied subjects are required of students who choose horticulture as a major, and twelve hours are required of those who select it as a minor. The department will waive certain of these requirements for some fields of major study if the student has had an equivalent preparation in the fundamental sciences. It is desirable when the major field of study is decided upon during the junior or senior year, to select the fundamental science courses accordingly and, if possible, to include in the undergraduate preparation the elementary courses in German or French.

Advanced work in botany, chemistry, entomology, agronomy, or agricultural economics may be taken advantageously with horticulture to make a well-balanced course of graduate study.

Courses for Graduates

103. Vegetable Crops Research.—Once a week; both semesters. *One-half to four units.* Professor Huelsen, Associate Professor McCollum, Assistant Professor Skok.
106. Vegetable Crops Seminar.—Once a week; first semester. *One-fourth unit.* Professor Huelsen, Associate Professor McCollum, Assistant Professor Skok.

108. Pomology Research.—Once a week; both semesters. *One-half to four units.*
(a) Fruit Breeding.—Professor Dorsey.
(b) Pomological Physiology.—Professor Ruth.
(c) Small Fruits.—(Not given second semester of 1947-1948.) Professor Colby.
(d) Fruit Structure and Composition.—Associate Professor Lott.

115. Floriculture Research.—Once a week; both semesters. *One-half to four units.* Associate Professor Weinard.

120. Pomology Seminar.—Once a week; both semesters. *One-fourth unit.* Professors Ruth, Anderson, Colby, Associate Professor Lott.

125. Fruit Development.—Three times a week; second semester. *One unit.* Associate Professor Lott.

130. Physiology of Fruit Production.—Three times a week; first semester. *One unit.* Professor Ruth.

140. Advanced Small Fruit Culture.—Three times a week; second semester. *One-half to one unit.* (Not given in 1947-1948.) Professor Colby.

150. Research in Horticultural Pathology.—Same as Botany 100e. Three times a week; both semesters. *One-half to four units.* Credit allowed for four semesters. A thesis or formal report is required if taken for more than one unit each semester.
(a) Fruits.—Professor Anderson.
(b) Vegetables.—Professor Anderson, Assistant Professor Linn.
(c) Viruses.—Associate Professor Thornberry.
(d) Ornamentals.—Associate Professor Weinard.
(e) Metabolism of Microorganisms.—Associate Professor Thornberry, Assistant Professor Gottlieb.

151. Special Problems in Fruit Diseases.—Three times a week; both semesters. *One-half to four units.* Credit allowed toward degree in plant pathology. Professor Anderson, Associate Professor Thornberry.

152. Special Problems in Vegetable Diseases.—Three times a week; both semesters. *One-half to four units.* Credit allowed toward degree in plant pathology. Professor Anderson, Assistant Professor Linn.

177. Virus Diseases of Plants.—Same as Botany 177. Twice a week; second semester. *One unit.* (Given in 1947-1948 and in alternate years.) Associate Professor Thornberry.

Courses for Graduates and Advanced Undergraduates

12. Evolution of Horticultural Plants.—Three times a week; second semester. (Given in 1947-1948 and in alternate years.) Professor Dorsey.

43. Floricultural Physiology.—Three times a week; first semester. Associate Professor Weinard.

44. Current Pomological and Vegetable Crops Literature.—Once a week; both semesters. This course may be taken for four successive semesters, designated as Horticulture 44a, 44b, 44c, and 44d. Professor Ruth.

45. Plant Nutrition.—Three times a week; second semester. Associate Professor Weinard.

51. Fruit Diseases.—Same as Botany 51. Three times a week; first semester. (Given in 1947-1948 and in alternate years.) Professor Anderson.

52. Vegetable Diseases.—Same as Botany 52. Three times a week; first semester. (Given in alternate years; not given in 1947-1948.) Professor Anderson, Assistant Professor Linn.

56. Growing Vegetables for Manufacture.—Three times a week; second semester. Professor Huelsen.

HUMANITIES

Courses for Graduates and Advanced Undergraduates

1. Introduction to Linguistics.—Three times a week; first semester. Associate Professor Kahane.

JOURNALISM

Graduate work in journalism is conducted in the following fields: advertising and editorial problems. The program of graduate study is limited to the Master of Science degree. Candidates for this degree must have had at least twenty hours of undergraduate journalism and must complete satisfactorily the following: (1) a major consisting of four units in journalism, or three units in journalism and one additional unit approved by the graduate adviser and the Dean of the Graduate School; (2) at least two units in a subject other than journalism — for editorial students, history, political science, sociology, English, economics, psychology, and philosophy are recommended; for advertising and publication management students, economics, home economics, and business organization and operation are recommended; (3) a minimum of eight units.

Courses for Graduates

101a-101b. Research in Special Topics (Thesis).—Once a week; both semesters. *One to two units.* Professors Sandage, Siebert.

103a-103b. Seminar in Editorial Policies and Problems.—Research in selected topics. Both semesters. *One to two units.* Professor Siebert.

104a-104b. Seminar in Advertising Policies and Problems.—Research in selected topics. Both semesters. *One to two units.* Professor Sandage.

Courses for Graduates and Advanced Undergraduates

22. Radio Law.—Federal legislation, with emphasis on Communications Act of 1934 and the regulations of the Federal Communications Commission, legal problems in program operations, censorship and editorial selections, copyright, and author-producer relations. Twice a week; second semester. Professor Siebert.

38. Advertising Campaigns.—Same as B.O.O. 18. Three times a week; both semesters. Assistant Professor Wedding.

39. Radio Advertising.—Economics, standards, and ethics as applied to radio commercials; sponsorship, rates, and advertising techniques, including merchandising, marketing, servicing, and sales; preparation and presentation of radio advertising copy, measurements, and listener surveys. Twice a week; first semester. Professor Sandage.

LANDSCAPE ARCHITECTURE

Master of Fine Arts in Landscape Architecture. — The prerequisite for graduate work in landscape architecture is a bachelor's degree in landscape architecture comparable to the degree conferred by the University of Illinois.

To qualify for this degree a student must take the seminar and thesis course for four units, and at least four additional units chosen from the following:

	UNITS
Architecture (advanced undergraduate courses in design or history)	1
Botany (advanced undergraduate or graduate courses)	1
C.E. 103—Highway Engineering	1
C.E. 120—Highway Traffic, Transport, and Safety	1
L.A. 136—Landscape Design	1–2
L.A. 147—Landscape Construction	1–2
L.A. 157—Advanced Planting Design	1–2

Master of Science in City Planning. — College graduates in architecture, civil engineering, landscape architecture, and the social sciences are offered an

opportunity to prepare themselves for careers in city, state, and regional planning. After completing their preparation they will be qualified for positions with city, metropolitan, state, and regional planning commissions and with planners in independent practice.

The prerequisite for graduate work in city planning is a bachelor's degree in architecture, civil engineering, landscape architecture, or the social sciences, and must include the following courses or their acceptable equivalent:

	HOURS
Planning of towns and cities	4
Sociology (urban, rural, or regional)	3
Political Science (municipal government or municipal problems)	3
Economics (public utilities or transportation)	3
Design (either landscape or architectural design or highway and municipal design, airport design, regional design)	12

To qualify for this degree a student must take the seminar and thesis course for four units and at least four additional units from the following:

	UNITS
Arch. 104—Design	1
C.E. 110—Sewage and Water Disposal and General Sanitation	1
C.E. 120a—Highway Engineering	1
C.E. 123—Highway Traffic, Transport, and Safety	1
C.E. 135—Municipal Engineering	1
C.E. 140a—Water Supply	1
Econ. 105—Public Finance	1
Econ. 165—Social Control of Business	1
Econ. 195—Economics of Transportation	1
L.A. 137—City Planning Design	1–2
Pol. Sci. 104—Municipal Administration	1
Pol. Sci 111—Government and the Economic Order	1
Pol. Sci. 128—Contemporary Government Problems	1
Sociol. 106—Urban Communities and Urbanization	1
Sociol. 114—Public Opinion	1
Sociol. 122—Regional Problems and Planning	1
Sociol. 110—Population Problems	1

Courses for Graduates

136. Landscape Design.—Both semesters. *One to two units.* Professor White.
137. City Planning Design.—Theory and design. Both semesters. *One to two units.* Professor Lohmann.
147. Landscape Construction.—Both semesters. *One to two units.* Professor Schaffer.
157. Advanced Planting Design.—Both semesters. *One to two units.* Associate Professor Robinson.
158. Seminar.—Both semesters. *One-half unit.* Members of the staff.
159. Thesis.—Both semesters. *One and one-half units.* Members of the staff.

Courses for Graduates and Advanced Undergraduates

35-36. Landscape Design (Advanced).—Five times a week; both semesters. Professor Lohmann.
53-54. Planting Design.—Four times a week; both semesters. Associate Professor Robinson.

LATIN

(See Classics)

LIBRARY SCIENCE

Applicants for admission to the Graduate School for advanced work in library science must have fulfilled the following minimum requirements: a bachelor's degree in arts or sciences from the University of Illinois, or other equivalent training; successful completion of a professional program in an accredited library school, or an equivalent satisfactory to the University of Illinois Library School; one year of library experience, or an equivalent acceptable to the Library School; a reading knowledge of one modern foreign language (students specializing in bibliographical work and in college or university library administration must have a reading knowledge of at least two foreign languages); evidence of ability to pursue graduate work. Other desirable preparation includes: specialization in at least one major subject field; a knowledge of additional foreign languages; a working knowledge of statistics, applied psychology, business methods; ability to speak in public.

Courses in library science leading to the degree of Master of Science are offered which provide an opportunity for specialization in several different fields. Each student must choose one field of specialization. His program of courses is selected under the direction of a faculty adviser and must be approved by the Library School and the Graduate School at registration and again upon admission to candidacy. Course 111 is required of all students. All students must pass a comprehensive examination before admission to candidacy.

Not later than the time of admission to candidacy each student must elect, subject to the approval of the Library School, one of two plans of study. Plan I emphasizes research and requires the preparation of a thesis, which must be completed within three years of the student's first registration in Library Science 101. Plan II gives major attention to intensive study of some specialized field of library science and requires a written report on a problem in that field. Under Plan II the student must complete a minimum of nine units, and all of the requirements for the degree must be fulfilled within three years after admission to candidacy.

A student may combine a major in library science with a minor in any special subject for which he is adequately prepared .

By special arrangement in certain departments of the University, library science is accepted as a minor toward the degree of Doctor of Philosophy if the candidate has a master's degree in library science.

Courses for Graduates

101. Thesis.—Both semesters. *One to two units.* Professor Downs and others.

102. Individual Research.—Both semesters. *One to two units.* Professor Downs and others. Seminar classes will be formed if enough students choose the same subject for individual research. Some suggested fields of investigation include:
   (a) Administration of Reference Service.
   (b) Modern Publishing.
   (c) Larger Units of Library Service (County, State, Regional).
   (d) Administration of Ephemeral Material.
   (e) Teaching of Library School Subjects.

104a. Advanced Classification.—History and philosophy of classification; comparative study of classification systems with special emphasis on the system used by the Library of Congress. Critical study of subject headings. Individual studies of special administrative problems or of the problems of classification of special types of material. Once a week; two hours; first semester. *One-half unit.* Associate Professor Bond.

104b. Advanced Cataloging.—History and philosophy of cataloging; comparative study of cataloging rules and of rules for filing in a catalog; cataloging of more difficult types of material such as incunabula, rare books, manuscripts, and archives. Administrative problems in cataloging. Individual studies in the problems of cataloging. Once a week; two hours; second semester. *One-half to one unit.* Associate Professor Bond.

108. Library Trends.—A survey of the library today, with a consideration of its future development as a social institution. Special emphasis is given to parallel trends in sociological, educational, and governmental fields. Three times a week; first semester. *One unit.* Professor Lancour.

109. Problems of College and University Library Administration.—The functions and organization of various types of college and university libraries; intensive study of selected cases to illustrate typical problems in connection with budget, personnel, equipment, instruction in the use of the library, etc. Once a week; two hours; first semester. *One unit.* Professor Downs.

111. Methods of Investigation in Librarianship.—Research methods and their application to the problems of librarianship; a survey of recent research in librarianship, with analysis of typical studies. Three times a week; first semester. *One unit.* Assistant Professor Goldhor.

112. Resources of American Libraries.—The distribution and extent of American library resources for advanced study and research; methods of surveying library facilities; growth and uses of union catalogs and bibliographical centers; interinstitutional agreements for specialization of collections and other forms of library cooperation; types of library materials; ways and means of developing research collections in special subject fields. Once a week; two hours; second semester. *One unit.* Professor Downs.

113. Departmental Libraries.—Administrative and bibliographic aspects of departmental libraries in the university library system. Building and evaluating the collection. Each student is expected to select one subject field for special study. Once a week; two hours; second semester. *One-half unit.* Associate Professor Branscomb and others.

114. Advanced Bibliography.—Designed to enable the student to utilize effectively all the varied resources of a large research library; methods of analyzing and solving bibliographic problems which arise in scholarly libraries and in connection with research projects. Three times a week; second semester. *One unit.* Assistant Professor Phelps.

115. Seminar in Government Publications.—Investigation of problems of selection, acquisition, organization, and use of collections of American federal, state, and municipal publications and those of important foreign governments. Three times a week; first semester. *One unit.* Assistant Professor Phelps.

116. Problems of School Library Service.—Analysis of school library service toward solving its unique problems inherent in the special factors of young readers and of the objectives, organization, educational method, and administration of the school and the school library. Once a week; two hours; first semester. *One unit.* Assistant Professor Hostetter.

117. School Library Collection.—Criteria for the selection and use of reading and audio-visual materials in the school derived from the study of selected research publications in child development, psychology, sociology, language arts and reading, and library science. Once a week; two hours; second semester. *One unit.* Assistant Professor Hostetter.

120. Problems in the Administration and Organization of Public Library Service.—Critical analysis of the major problem areas in the administration, organization, and functioning of municipal public libraries, with special attention to governmental relationships. Three times a week; first semester. *One unit.* Assistant Professor Goldhor.

Courses for Graduates and Advanced Library School Students

53. Biological Literature and Reference Work.—Twice a week; first semester. *One-fourth unit.* Assistant Professor Bamber.

54. Audio-Visual Aids and Library Service.—Descriptive course designed to acquaint the student with the theories of educational use of audio-visual materials, and with their administration in library service. Three times a week; second semester. *One-half to one unit.*
73. Service in Special Libraries.—Principles and methods of organizing and administering collections for the special subject fields; emphasis is placed on the literature of the fields, the use of subject bibliographies and catalogs, and the development of special services. Twice a week; second semester. *One-half unit.*
90. History of Books.—The origin and evolution of the alphabet and of scripts; the history of manuscript books; the invention and spread of printing; the history of the production and distribution of printed books. Emphasis is placed on the relation of the book to the social conditions of the various periods studied. Three times a week; second semester. *One-half to one unit.*
91. Psychology for Librarians.—The application of psychological principles and techniques to library service. Twice a week; second semester. *One-half unit.*
92. The Library and the Community.—Nature and types of communities; community problems; community agencies, changes and organization; the library's place in the community, particularly as an agency of adult education. Twice a week; second semester. *One unit.*

MATHEMATICS

Students beginning graduate study with a major in mathematics must have had twenty hours of undergraduate work in mathematics besides the usual freshman courses in algebra, trigonometry, and analytic geometry, including a one-year course in calculus and one year of more advanced work in one or more of the fields of algebra, analysis, and geometry. They should be able to read German or French.

Candidates for a Doctor of Philosophy degree taking a first minor in mathematics are expected to have completed a course in calculus and are required to take two one-year courses beyond the calculus. Those taking a second minor are required to complete at least one course throughout a year beyond the calculus.

The more technical courses offered by the department are arranged mainly in cycles of two or of three years, so that a properly qualified student will usually have opportunity to take any particular course at some time during the three years of residence required for the doctor's degree.

Candidates for the degree of Master of Science in the Teaching of Mathematics must earn four units in mathematics, two units of which are electives, two units in education, and two units in electives. Requirements are Mathematics 70a or 72a, 1 unit; Mathematics 70b or 72b, 1 unit; Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The elective courses in mathematics and the other electives must be selected with the approval of the adviser. The electives may be in mathematics, in education, or, in exceptional cases, in other fields.

Candidates for the degree of Master of Science in the Teaching of Mathematics and the Physical Sciences must earn two units in mathematics, one unit in chemistry, one unit in physics, two units in education, and two units in electives. Requirements are Mathematics 71a or 18, 1 unit; Mathematics 71b or 19, 1 unit; Chemistry 40, Physical Chemistry, 1 unit; Physics 20b, Theoretical Mechanics, 1 unit; Education 101, Philosophy of Education, or Education 30, History of Ameri-

can Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The electives may be in mathematics, in education, in chemistry, or in physics.

Courses for Graduates

100. Seminar and Thesis.—For thesis work or for special reading with the consent of the instructor. Three times a week; both semesters. *One to two units.* Professors Brahana, Trjitzinsky, Baer, Doob, Bourgin, Ketchum, Miles, Associate Professors Levy, Day, Assistant Professor Chanler. For the master's degree: Associate Professors Moore, Mendel, Peters, Assistant Professors Steimley, Vaughan, Pepper, Wilson, Bower, Armstrong, Dr. Munroe.
101. Functions of Real Variables.—Three times a week; both semesters. *One unit.* (Not given in 1947-1948.) Professor Doob.
102. Functions of a Complex Variable.—Three times a week; both semesters. *One unit.* (Not given in 1947-1948.) Professor Doob.
104. Topology.—Three times a week; both semesters. *One unit.* Professor Bourgin.
111. Differential Equations.—Three times a week; both semesters. *One unit.* (Not given in 1947-1948.) Professor Trjitzinsky.
115. Advanced Topics in the Theory of Functions.—Three times a week; both semesters. *One unit.* (Not given in 1947-1948.)
116. Topics in Classical Analysis.—Three times a week; both semesters. *One unit.* (Not given in 1947-1948.)
117. Analysis in Function Spaces.—Three times a week; both semesters. *One unit.* (Not given in 1947-1948.) Professor Bourgin.
124. Theory of Numbers.—Three times a week; both semesters. *One unit.* Professor Baer.
126. Theory of Groups.—Three times a week; both semesters. *One unit.* (Not given in 1947-1948.) Professor Brahana.
127. Fundamentals of Geometry.—Three times a week; both semesters. *One unit.* (Not given in 1947-1948.) Professor Baer.
129. Theory of Statistics.—Three times a week; both semesters. *One unit.* Professor Doob.
131. Algebraic Geometry.—Three times a week; both semesters. *One unit.* (Not given in 1947-1948.)
132. Ideal Theory and Algebraic Varieties.—Three times a week; both semesters. *One unit.* (Not given in 1947-1948.)
133. Advanced Topics in Algebraic Geometry.—Three times a week; both semesters. *One unit.*
135. Differential Geometry.—Three times a week; second semester. *One unit.* Associate Professor Levy.
151. Linear Operations.—Three times a week; both semesters. *One unit.* Associate Professor Day.
169. Elements of Higher Geometry and Algebra.—Three times a week; both semesters. *One unit.* Assistant Professor Chanler.
170. Algebra.—Three times a week; both semesters. *One unit.* Professor Brahana.
171. Analysis.—Three times a week; both semesters. *One unit.* Professor Trjitzinsky.
172. Geometry.—Three times a week; both semesters. *One unit.* Associate Professor Levy.
175. Applied Mathematics.—Three times a week; both semesters. *One unit.* Professor Ketchum.

Courses for Graduates and Advanced Undergraduates

16a-16b. Differential Equations.—Three times a week; both semesters.
18. Advanced Calculus.—Three times a week; both semesters.
19. Differential Equations and Orthogonal Functions.—Three times a week; both semesters.

21. Theory of Probability.—Three times a week; second semester. Dr. Munroe.
24. Statistical Methods or Quality Control.—Three times a week; second semester. Assistant Professor Bower.
30a-30b. Actuarial Theory.—Three times a week; both semesters. Associate Professor Peters.
35. Teachers' Course.—May be counted only toward a minor in mathematics. Three times a week; first semester. Assistant Professor Armstrong.
36. Advanced Aspects of Euclidean Geometry.—Three times a week; second semester. Assistant Professor Armstrong.
40a-40b. Fundamental Concepts of Mathematics.—Three times a week; both semesters. Assistant Professor Vaughan.
41. Vector and Tensor Analysis.—Three times a week; first semester. Professor Bourgin.
70a-70b. Introduction to Higher Algebra.—Three times a week; both semesters. Professor Baer, Dr. Landin.
71a-71b. Introduction to Higher Analysis.—Three times a week; both semesters. Professor Doob, Associate Professor Mendel.
72a-72b. Introduction to Higher Geometry.—Three times a week; both semesters. Associate Professor Levy.
74a-74b. Advanced Algebra.—Three times a week; both semesters. Professor Miles, Dr. Ferguson.
75a-75b. Introduction to Applied Mathematics.—Three times a week; both semesters. Professor Ketchum, Dr. Scott.

MECHANICAL ENGINEERING

The prerequisite for graduate work in mechanical engineering is the equivalent of the undergraduate course required for the degree of Bachelor of Science in mechanical engineering in the branch of the subject in which registration is desired. Courses offered to junior and senior students are open for minor credit to students whose major is in other departments.

Courses for Graduates

107. Thermodynamics.—Mathematics of thermodynamics; application of thermodynamics to the solution of physical and engineering problems. Twice a week; both semesters. *One unit.* Professor Espy.
108. Flow of Fluids and Heat Transfer.—Application of dimensional analysis to the theory of fluid flow and heat transmission, leading to design of heat transfer equipment. Twice a week; both semesters. *One unit.* Professor Larson.
109. Mechanical Engineering Design.—Machine design, power plant design, dynamics of machinery. Twice a week; both semesters. *One unit.* Professors Ham, Ryan.
110a-110b. Advanced Heating, Ventilating, and Air Conditioning.—Applications of various systems, notable developments, results of research. Individual problems. Twice a week; both semesters. *One unit.* Professor Konzo.
112. Laboratory Investigations.—Special problems in: (a) combustion; (b) steam; (c) gas and oil engineering; (d) heating, ventilating, and air conditioning; (e) refrigeration; (f) flow of fluids; (g) heat transfer; (h) mechanical transmission of power; (i) railway equipment. Three times a week; both semesters. *One to two units.* Professors Parker, Ham, Konzo, Fellows, Trigger, Larson, Assistant Professor Martin.
117. Advanced Refrigerating Engineering.—Advanced theory and special cycles; design of comfort cooling and other special installations. Twice a week; both semesters. *One unit.* Professor Macintire.

120. Locomotive Design.—Economic and legal considerations; specifications; weight and distribution; relation of steam pressure, compounding, and superheat to performance and economy. Both semesters. *One unit each semester.* (Not given in 1947-1948.)
121. Locomotive Operation.—Train resistance and locomotive tractive force; tonnage ratings. Both semesters. *One unit each semester.* (Not given in 1947-1948.)

MINING AND METALLURGICAL ENGINEERING

METALLURGICAL ENGINEERING

The prerequisite for graduate work with metallurgical engineering as a major is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in Metallurgical Engineering. Courses for advanced undergraduates are open for minor credit to students in other departments who have adequate preparation in physics, chemistry, and mechanics.

Courses for Graduates

101. Research in Metallurgy.—Both semesters. *One to two units.* Professor Walker, Associate Professor Eckel, Assistant Professors Bruckner, Forsyth.
102.[1] Advanced Physical Metallurgy.—Three times a week; first semester. *One unit.* Associate Professor Eckel.
103. Advanced Alloy Steels and Special Ferrous Alloys.—Three times a week; second semester. *One unit.* Assistant Professor Forsyth.
104.[1] Advanced Metallographic Technique.—Twice a week; both semesters. *One unit.* Professor Walker.

Courses for Graduates and Advanced Undergraduates

10. Principles of Physical Metallurgy.—Four times a week; first semester. Associate Professor Eckel.
11. Metallurgy of Iron and Steel.—Three times a week; first semester.
13. Metallography and Heat Treatment of Iron and Steel.—Three times a week; second semester. Associate Professor Eckel.
14. Ferrous Metallography Laboratory.—Twice a week; second semester. Associate Professor Eckel.
16. Metallurgy of Non-Ferrous Metals.—Three times a week; second semester. Assistant Professor Ricketts.
20. Non-Ferrous Metallography.—Three times a week; first semester. Associate Professor Eckel.
21. Non-Ferrous Metallography Laboratory.—Twice a week; first semester. Associate Professor Eckel.
22. Electrometallurgy.—Three times a week; first semester. Assistant Professor Ricketts.
23. Metallurgy of Deep Drawing and Pressing.—Three times a week; second semester. Assistant Professor Forsyth.
24. Alloy Steels.—Three times a week; second semester. Assistant Professor Forsyth.
26. Advanced Physical Metallurgy Laboratory.—Twice a week; both semesters. Members of the staff.
30. Engineering Metallurgy.—Three times a week; first semester. Assistant Professor Forsyth.

[1] Of courses 102 and 104 only one will be given each semester, according to election of students.

40. Metallurgy of Welding.—Three times a week; second semester. Assistant Professor Bruckner.
41. Powder Metallurgy.—Three times a week; first semester. Associate Professor Eckel.
42. Metallurgy of Steel Castings.—Three times a week; second semester.
43. Physics of Metals.—Three times a week; first semester.

MINING ENGINEERING

The prerequisite for graduate work with mining engineering as a major is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in Mining Engineering. Courses for advanced undergraduates are open for minor credit to students whose major is in other departments who have adequate preparation in physics, mathematics, and mechanics .

Courses for Graduates

101. Research in Mining Engineering and Mineral Dressing.—Both semesters. *One to two units.* Professors Walker, Chedsey.
102. Advanced Mineral Dressing and Coal Preparation.—Twice a week; both semesters. *One unit.* Professor Chedsey.
104.[1] Mine Valuation, Taxation, and Mineral Economics.—Twice a week; both semesters. *One unit.* Professor Chedsey.
105.[1] Advanced Mine Administration.—Twice a week; both semesters. *One unit.* Professor Chedsey.

Courses for Graduates and Advanced Undergraduates

10. Haulage, Hoisting, and Pumping.—Four times a week; first semester.
11. Mine Ventilation.—Twice a week; second semester.
20. Mine Administration.—Three times a week; first semester.
21. Mineral Dressing.—Three times a week; first semester.
23. Examination and Valuation.—Twice a week; second semester.
24. Mining Design.—Three times a week; second semester.
25. Coal Preparation.—Twice a week; second semester.

MUSIC

An applicant for admission to the Graduate School as a candidate for the degree of Master of Music or the degree of Master of Science in Music Education is required to have finished successfully a four-year undergraduate curriculum in music or in music education respectively.

A candidate who holds a bachelor's degree from an accredited institution or school of music will be considered under the following conditions: (1) The degree must be based on a four-year curriculum in music. (2) The undergraduate work presented for the degree of Bachelor of Music, or its equivalent, must include not less than fourteen hours in academic subjects, with not less than the equivalent of two years of college work in foreign languages, one year of which must be in French, German, or Italian. For the degree of Bachelor of Science in Music Education, or its equivalent, the academic and education courses taken must meet the requirements of the Illinois State Certificating Law for Teachers. (3) The applicant must pass a qualifying examination in the branch of music which he wishes to pursue as his major, this examination being under the supervision of the Graduate Committee of the School of Music.

[1] Of courses 104 and 105 only one will be given each semester, according to election of students.

For the degree of Master of Music, the major field may be in musicology, music theory and composition, music literature, applied music, or band and orchestra conducting. For the field of musicology, a reading knowledge of both German and French is desirable.

Candidates for the degree of Master of Science in Music Education must earn four units in music, one of which is an elective, two units in education, and two units in electives. Requirements are Music 130, 1 unit; Applied Music Major, 2 units; Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The electives must be selected with the approval of the adviser. One elective must be in music, and the other two in music, in education, or, in exceptional cases, in other fields.

Courses for Graduates

100a-100b. Contrapuntal Forms of Composition.—Twice a week; both semesters. *One-half unit.* Professor Kessler.

101a-101b. Chromatic and Modern Harmony.—Twice a week; both semesters. *One-half unit.* Professor Kessler.

105a-105b. Advanced Composition.—Twice a week; both semesters. *One unit.* Professor Kessler.

106a-106b. Advanced Instrumentation.—Twice a week; both semesters. *One-half to one unit.* Professor Harding, Assistant Professor Kelly.

110. Instrumental Music of the Eighteenth Century.—Once a week; two hours; first semester. *One unit.* Professor Hill.

111. The Sonata.—Once a week; two hours; second semester. *One unit.* Professor Hill.

112a-112b. Beethoven.—Once a week; two hours; both semesters. *One unit.* (Not given in 1947-1948.) Professor Hill.

113a-113b. Johann Sebastian Bach.—Once a week; two hours; both semesters. *One unit.* Professor Miles.

115a-115b. Applied Music.—Piano, organ, voice, violin. Three times a week; both semesters. *One and one-half units.* Professors in applied music.

116a-116b. Applied Music.—Piano, organ, voice, violin. Three times a week; both semesters. *One and one-half units.* Professors in applied music.

120a-120b. Research in Special Fields.—Time to be arranged; both semesters. *One to two units.* Professors Kuypers, Harding, Miles, Hill, Kessler, Associate Professors Branigan, V. Wilson, Assistant Professor Kellogg.

130. Administration and Supervision of Music Education.—Twice a week; second semester. *One unit.* Associate Professor V. Wilson.

138a-138b. Advanced Conducting, Administration, and Literature.—Twice a week; both semesters. *One to one and one-half units.* Professor Harding.

142a-142b. Piano Literature.—Twice a week; both semesters. *One to one and one-half units.* Professor Kessler.

152a-152b. Vocal Literature.—Twice a week; both semesters. *One to one and one-half units.* Assistant Professor Kellogg.

162a-162b. String Instruments Literature.—Twice a week; both semesters. *One to one and one-half units.* Associate Professor Roosa.

182a-182b. Organ Literature.—Twice a week; both semesters. *One to one and one-half units.* Professor Miles.

Courses for Graduates and Advanced Undergraduates

6a-6b. Theory of Music.—Free counterpoint. Twice a week; both semesters. Assistant Professor Kelly.

9-10. Analysis of Musical Form.—Twice a week; both semesters. Professor Hill.

11a-11b. Composition in Smaller Forms.—Once a week; both semesters. Assistant Professor Kelly.

12a-12b. Composition in Larger Forms.—Twice a week; both semesters. Assistant Professor Kelly.
19a-20a. Double Counterpoint, Canon, and Fugue.—Three times a week; both semesters. Professor Kessler.
28a-28b. Music Dramas of Richard Wagner.—Twice a week; both semesters. Mr. Zirner.
29. Teaching of Theory and Harmony.—Twice a week; two hours; first semester.
32-33. Advanced History of Music.—Twice a week; both semesters. Professor Hill.

Applied Music (Junior and Senior Grade)

(Only students who can qualify to enter these courses as major students may elect them for graduate credit.)

44a-47b. Piano.—Twice a week; both semesters. Professor Schoonmaker, Associate Professors Watt, Fletcher, Branigan.
54a-57d. Voice.—Twice a week; both semesters. Professor Foote, Assistant Professors Hamp, Kellogg, Bowen, G. Wilson.
64a-67b. Violin.—Twice a week; both semesters. Associate Professor Rolland.
74a-77b. Violoncello.—Twice a week; both semesters. Assistant Professor Potter.
84a-87b. Organ.—Twice a week; both semesters. Professor Miles.
94a-97b. Wind Instruments.—Twice a week; both semesters. Mr. McDowell.

PHILOSOPHY

Students beginning graduate work with philosophy as their major subject must have had a general course in the history of philosophy, a course in logic, and a general course in psychology.

Courses for Graduates

100. Research.—Both semesters. *One-half to two units.* Professors in the department.
106. British Empiricism (Hobbes, Locke).—Twice a week; first semester. *One unit.* (Not given in 1947-1948.) Associate Professor Will.
109. Recent American Philosophy.—Twice a week; first semester. *One unit.* Professor Fisch.
112. German Idealism (Kant).—Twice a week; second semester. *One unit.* Professor McClure.
119a. Seminar in Ancient Philosophy (Plato).—Twice a week; first semester. *One unit.* Professor McClure.
119b. Seminar in Ancient Philosophy (Aristotle).—Twice a week; second semester. *One unit.* Professor Fisch.
124a. Contemporary Problems.—The foundations of inductive knowledge. Twice a week; first semester. *One unit.* Professor Will.
124b. Contemporary Problems.—Recent contributions to the theory of value. Twice a week; second semester. *One unit.* Professor Fisch.

Courses for Graduates and Advanced Undergraduates

3. History of Ancient and Medieval Philosophy.—Three times a week; first semester. Professor McClure.
4. History of Modern Philosophy.—Three times a week; second semester. Professor McClure.
8. Three Philosophical Poets (Goethe, Dante, Lucretius).—Three times a week; second semester. Professor Fisch.
9. Philosophy of Law and of the State.—Three times a week; first semester. (Not given in 1947-1948.) Professor Fisch.

10. Philosophy of Science.—Three times a week; second semester. Assistant Professor Turquette.
11. Philosophy of Religion.—Three times a week; second semester. Associate Professor Nicholson.
12. Philosophy of Art.—Three times a week; second semester. Professor Gotshalk.
13. Ethics and Value Theory.—Three times a week; first semester. Professor Fisch.
15. Great Books in Modern Thought (Hume, Darwin, Marx, Freud).—Three times a week; first semester. Associate Professor Will.
17. Symbolic Logic.—Three times a week; first semester. Assistant Professor Turquette.
18. Philosophical Ideas: Rousseau to Bergson.—The ideas of reason, freedom, and progress. Three times a week; first semester. Professor Fisch.
21. Theory of Knowledge.—Three times a week; second semester. (Not given in 1947-1948.) Associate Professor Will.
22. American Philosophy.—Three times a week; first semester. Professor Fisch.
23. The Philosophy of Plato.—Three times a week; first semester. Professor Fisch.
24. Medieval Philosophy.—Three times a week; second semester. Assistant Professor Diggs.

PHYSICAL EDUCATION

The graduate program leading to the degree of Master of Science in Physical Education offers two options: Option 1 is for students who propose to specialize in the areas of physical education, sports, health, safety, physical fitness, rehabilitation, recreation, and camping. Option 2 is for students who propose to teach and/or administer these programs.

Admission Requirements. — For Option 1 the admission requirements are 30 hours of approved undergraduate credit in physical education (candidates with experience in physical education may receive partial credit toward admission up to a maximum of eight hours); 18 hours of credit in approved undergraduate work in science; and a course in the theory of tests and measurements or a course in theory of statistics. For Option 2, in addition to the above, 16 hours of approved undergraduate credit in education is required.

Graduation Requirements. — The graduation requirements for Option 1 are a total of 8 units of credit, including a minimum of 4 units of credit in physical education courses; registration in and satisfactory completion of Physical Education 110; and presentation of an acceptable thesis (2 units). Candidates may petition to waive the thesis requirement. Those who are excused, however, in addition to securing 8 units of credit in courses, are required to take and pass a final comprehensive examination (oral or written) in physical education. For Option 2, same as above except 2 units of graduate credit in education, including Education 125 (one unit), are required.

Courses for Graduates

102. Problems in Physical Education.—Once a week; two hours; second semester. *One unit.* Professor Staley, Associate Professor Jackson.
103. Problems in Safety Education.—Once a week; two hours; first semester. *One unit.* Professor Stafford.
104. Problems in Health Education.—Once a week; two hours; both semesters. *One unit.* Professor Stafford.

105. Philosophy of Sport.—Once a week; two hours; first semester. *One unit.* Professor Staley.
106. Techniques of Research in Health, Physical Education, and Recreation.—Once a week; two hours; both semesters. *One unit.* Professor Cureton.
107. Trends and Techniques in Rehabilitation.—Once a week; two hours; second semester. *One unit.* Professor Stafford.
108. Scientific Foundations of Physical Fitness.—Once a week; two hours; second semester. *One unit.* Professor Cureton.
109. Research.—Arrange; both semesters. *One-half to two units.* Members of the staff.
110. Seminar.—Once a week; two hours; both semesters. No credit. Members of the staff.
111. Problems in Recreation.—Once a week, two hours; second semester. *One unit.*
112. Scientific Analysis of Physical Education Activities.—Once a week; two hours; second semester. *One unit.* Professor Cureton.

PHYSICAL SCIENCES

A special program leading to the degree of Master of Science in the Physical Sciences is available to meet the needs of students who wish to study in both chemistry and physics rather than to specialize in one department. It is designed primarily for those preparing to teach the physical sciences. Students working toward a degree under the provisions of this program are expected to seek approximately equal proficiency in both physics and chemistry; those whose undergraduate work has emphasized chemistry should balance this by weighting the graduate work in favor of physics, and vice versa. No thesis is required, and all courses in physics and chemistry which normally give graduate credit will carry credit toward the degree. To qualify for the degree, a student must have had, or must include in his program, at least one course in mathematics beyond the calculus, and for which the calculus is a prerequisite.

Candidates for the degree of Master of Science in the Teaching of the Physical Sciences must earn four units in the physical sciences, two units in education, and two units in electives. Requirements are the Physical Sciences, 4 units; Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational psychology, 1 unit. The courses in the physical sciences and the electives must be selected with the approval of the adviser. The electives may be in the Physical Sciences, in education, or, in exceptional cases, in other fields.

PHYSICS

A year of calculus and a year of general physics, with laboratory, are prerequisite for all major and minor graduate work in physics. In addition, graduate students whose major is physics must have had one more advanced course in either physics of mathematics and should be able to use references in German.

Candidates for the degree of Master of Science in the Teaching of Physics must earn four units in physics, two units in education, and two units in electives. Requirements are physics, 4 units; Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The courses in physics and the electives must be selected with the approval of the adviser. The electives may be in physics. in education, or, in exceptional cases, in other fields.

Courses for Graduates

122a-122b. Dynamics.—Three times a week; second semester. *One unit.* (122b not given in 1947-1948.) Professor Bartlett.

128. Problems and Methods in Theoretical Physics.—Three times a week; first semester. *One unit.* Professor Bartlett.

146a-146b. Electrodynamics.—Three times a week; both semesters. *One unit.* Professor Nordsieck.

163. Statistical Mechanics.—Three times a week; first semester. *One unit.* Professor Nordsieck.

181a. Quantum Mechanics.—Introductory course. Three times a week; first semester. *One unit.* Associate Professor Dancoff.

181b. Quantum Mechanics.—Collision theory and nuclear problems. Three times a week; second semester. *One unit.* Associate Professor Dancoff.

183a-183b. Nuclear Physics.—Three times a week; both semesters. *One unit.* Professor Goldhaber.

184. Line Spectra and Atomic Structure.—Three times a week; first semester. *One unit.* Professor Goldhaber.

186. Advanced Quantum Mechanics.—Theory of measurements, transformation theory, quantum electrodynamics, theory of elementary particles. Three times a week; first semester. *One unit.* Associate Professor Dancoff.

190. Research.—Both semesters. *One to three units.* Professors in the department.

191a-191b. Modern Laboratory Practice.—Emphasis on experimental atomic physics: vacuum technique, gaseous discharges, X-rays, thermionics, photoelectricity, electron diffraction, nuclear physics, etc. Both semesters. *One unit.* Assistant Professor Sherwin.

198. Seminar.—Both semesters. *One to two units.* Professors in the department.

199. Colloquium.—Attendance is required of all graduate students. Once a week; both semesters. *No credit.* Professor Goldhaber.

Courses for Graduates and Advanced Undergraduates

16. Elementary Heat.—Three times a week; first semester. Associate Professor Paton.

20a-20b. Theoretical Mechanics.—Three times a week; both semesters. Assistant Professor Becker.

40a-40b. Electricity and Magnetism.—Two lectures and a three-hour laboratory period weekly; both semesters. Assistant Professor Hanson.

46a-46b. Vacuum Tubes.—Applications to physical laboratory problems. Two lectures and one three-hour laboratory period weekly; both semesters. Associate Professor Lyman.

50a-50b. Biophysics.—Study of physical theories, methods, and techniques applicable to fundamental biological problems. Discussion of the effects of radiation on cell constituents, use of vacuum tube equipment, electron miscroscopes, metabolic processes, nerve conduction, muscular contraction. Three times a week; both semesters. Professor Bartlett.

51a-51b. Biophysics Laboratory.—A laboratory course, to supplement Physics 50, dealing with physical apparatus and techniques useful in biology, especially experiments and apparatus used in the study of absorption spectra, tracer-techniques, and photo-chemical yields; emphasis on the use of photoelectric cells, bioelectric apparatus, oscillographs, temperature control, and the electron microscope. One laboratory period a week; both semesters. (Not given in 1947-1948.)

60. Heat and Thermodynamics.—Three times a week; first semester. Associate Professor Paton.

62. Kinetic Theory of Heat and Radiation.—Three times a week; second semester. Professor Nordsieck.

71a-71b. Light.—For advanced students in physics, chemistry, mathematics, or engineering. Twice a week; both semesters. Professor Almy.

72a-72b. Light Laboratory.—To accompany Physics 71a-71b. Twice a week; both semesters. Professor Almy.

80. Atomic Physics.—A lecture and problem course presenting our modern knowledge of the nature and properties of atoms, molecules, electrons, light quanta, photoelectricity, atomic spectra, and Compton effect. Three times a week; first semester. Professor Kruger.
81. Radioactivity and Nuclear Physics.—Three times a week; second semester. Professor Kruger.

PLANT PATHOLOGY

Students may choose a major or minor in plant pathology. Work for the degree of Master of Science or Doctor of Philosophy in Plant Pathology is administered by a committee appointed by the Dean of the Graduate School and representing the various departments which conduct research work in this field. Before registering, candidates must have the approval of the committee which consists of Dr. N. E. Stevens, Dr. H. W. Anderson, and Dr. Benjamin Koehler.

Courses for which graduate credit will be given in Plant Pathology are listed below.

Courses for Graduates

Research.—Both semesters. *One-half to four units.* Work may be taken in the following fields, subject to approval of one of the staff:
Botany 100e. Plant Pathology.—Professor Stevens.
Agronomy 118b. Diseases of Field Crops.—Professor Koehler.
Horticulture 150. Horticultural Pathology.—
(a) Fruits.—Professor Anderson.
(b) Vegetables.—Professor Anderson, Assistant Professor Linn.
(c) Viruses.—Associate Professor Thornberry.
(d) Ornamentals.—Associate Professor Weinard.

Botany 117. Discussions in Plant Pathology and Mycology.—Once a week; both semesters. *One-fourth unit.* Professor Stevens.

Botany 171. Mycology of Special Groups.—Once a week; four hours; second semester. *One-half unit.* Professor Stevens, Assistant Professor Shanor.

Botany 172. Epidemiology of Plant Diseases.—Once a week; first semester. *One-half unit.* Professor Stevens.

Botany and Horticulture 177. Virus Diseases of Plants.—Twice a week; second semester. *One unit.* (Given in 1947-1948 and in alternate years.) Associate Professor Thornberry.

Courses for Graduates and Advanced Undergraduates

Botany 7. Plant Pathology.—Causes, diagnosis, and treatment of plant diseases. Three times a week; first semester. Professor Stevens.

Botany 72. General Mycology.—Structure, classification, and identification of fungi, including those of economic importance. Three times a week; second semester. Assistant Professor Shanor.

Botany 77. Diseases of Field Crops.—Three times a week; second semester. (Given in alternate years; not given in 1947-1948.) Professor Stevens.

Horticulture 51. Fruit Diseases.—Three times a week; first semester. (Given in 1947-1948 and in alternate years.) Professor Anderson.

Horticulture 52. Vegetable Diseases.—Three times a week; first semester. (Given in alternate years; not given in 1947-1948.) Professor Anderson, Assistant Professor Linn.

POLITICAL SCIENCE

Graduate work in political science is conducted in the following special fields: political theory; international law and relations; American and foreign governments; constitutional law, administrative law, and jurisprudence; public administration.

Candidates for advanced degrees in political science must have had at least twenty hours of undergraduate work in political science, economics, sociology, and history, not less than twelve hours of which must have been in political science (which may include three hours in constitutional history). If a student making political science his major is taking both of his minors in other departments, one of them must be in history, economics, or sociology.

Several courses given in other departments are so closly related to those in political science that graduate students whose major is political science may be permitted on petition to take such courses as part of their major work. Attention is called to the bulletin on *University Training for the Public Service* and to the courses in public law in the College of Law, the courses in public finance in the College of Commerce and Business Administration, the courses in city and regional planning in the College of Fine and Applied Arts, and the courses in municipal and sanitary engineering in the College of Engineering.

Graduate students in other departments who choose political science as a minor must have had at least six hours of undergraduate work in political science and three hours in economics, sociology, or history.

Courses for Graduates

101a-101b. History of Political Theories.—Twice a week; both semesters. *One unit.* Professor Wilson.

102. Nature of the State.—Twice a week; second semester. *One unit.* (Not given in 1947-1948.)

103a-103b. Seminar in Political Science and Public Law.—Once a week; both semesters. *One-half to four units.* Members of the department.

104. Municipal Administration.—Twice a week; first semester. *One unit.* Professor Kneier.

105. Constitutional Law.—Research in selected topics. First semester. *One unit.* Professor Mathews.

106. International Law.—Research in selected topics. First semester. *One unit.* Associate Professor Jobst.

107. Foreign Relations of the United States.—Research in selected topics. Second semester. *One unit.* (Not given in 1947-1948.)

108. Problems of International Organization.—Special problems in the field of international organization. First semester. *One unit.* Professor Berdahl.

111. Government and the Economic Order.—Selected problems. Twice a week; second semester. *One unit.* Associate Professor Hagan.

112. Problems in Public Administration.—Special topics in national, state, or local administration in the United States. Twice a week; first semester. *One unit.* (Not given in 1947-1948.)

113. State Government.—Research in selected topics. Second semester. *One unit.* Professor Mathews.

114. Political Parties.—Twice a week; first semester. *One unit.* Visiting Professor Barclay.

121. Problems in British Government.—Twice a week; first semester. *One unit.* (Not given in 1947-1948.)

Courses for Graduates and Advanced Undergraduates

4. Municipal Government.—Three times a week; first semester. Professor Kneier.

5. American Constitutional System.—Three times a week; first semester. Professor Mathews.

6a. International Law.—Three times a week; first semester. Associate Professor Jobst.

6b. International Law.—(Continuation of 6a.) Three times a week; second semester. Associate Professor Jobst.

7. American Foreign Relations.—Twice a week; second semester. (Not given in 1947-1948.)
8a. International Organization.—Three times a week; first semester. Professor Berdahl.
8b. International Organization.—(Continuation of 8a.) Three times a week; second semester. Professor Berdahl.
9. Principles of Jurisprudence.—Three times a week; first semester. Assistant Professor Manner.
11. The Constitution and Industrial Legislation.—Three times a week; second semester. Associate Professor Hagan.
12a. Public Administration.—Three times a week; first semester.
12b. Problems in Public Administration.—Twice a week; second semester.
13. Government and the Economic Order.—Three times a week; first semester. Associate Professor Hagan.
14a. Political Parties: Party History and Issues.—Three times a week; first semester. Visiting Professor Barclay.
14b. Political Parties: Organization and Methods.—Three times a week; second semester. Professor Berdahl.
18. Legislation in the United States.—Three times a week; first semester. Visiting Professor Barclay.
20. Rural Local Government.—Three times a week; second semester. Associate Professor Snider.
21. British Government.—Twice a week; first semester. (Not given in 1947-1948.) Professor Berdahl.
22. Government and Politics of Continental Europe.—Three times a week; second semester. Assistant Professor Sibley.
24. International Administration.—Twice a week; second semester. (Not given in 1947-1948.) Professor Berdahl.
26. Advanced State Government.—Twice a week; second semester. Professor Mathews.
30. History of Political Theory.—Three times a week; first semester. Assistant Professor Sibley.
31. American Political Theory.—Three times a week; first semester. (Alternates with Political Science 32; not given in 1947-1948.) Professor Wilson.
32. Principles of Political Science.—Three times a week; first semester. Professor Wilson.
33. Contemporary Political Theory.—Three times a week; second semester. Professor Wilson.
34. Municipal Problems.—Municipal administration in the United States and Europe. Three times a week; second semester. Professor Kneier.
38. International Relations.—Three times a week; second semester. Assistant Professor Manner.

PSYCHOLOGY

Graduate students who elect psychology as their major subject must have had standard courses, of university grade, both in general psychology and in the psychological laboratory.

Graduate training in clinical psychology may lead to the degree of Doctor of Philosophy or to the degree of Master of Science in Clinical Psychology. The requirements for the latter degree are completion of eight units of work in the Urbana departments and an interneship of six months in the Institute for Juvenile Research in Chicago, or other institution, agency, or department, upon recommendation of the Department of Psychology and the approval of the Dean of the Graduate School. No thesis is required. The work in Urbana shall include a minimum of four units in psychology and two units to be chosen from education and sociology. A prerequisite for full graduate standing in this curriculum is sixteen hours of undergraduate work in psychology, including at least one course each in statistics, child psychology, and clinical psychology.

A departmental requirement for both the degree of Master of Arts and Master of Science (in Clinical Psychology) is the passing of a comprehensive written examination in the general field of psychology.

Courses for Graduates

103a-103b. RESEARCH.—Experimental investigations. Both semesters. *One-half to two units.* Professors in the department.

105a-105b. SEMINAR.—Discussion of current topics in their historical setting, with special emphasis on research problems. Once a week; two hours; both semesters. *One unit.* Professor WOODROW.

106. NEURAL THEORY OF THE PSYCHOLOGICAL FUNCTIONS.—Once a week; two hours; first semester. *One unit.*

108. QUANTITATIVE METHODS.—Research methods in quantitative psychology. Once a week; two hours; second semester. *One unit.* Professor WOODROW.

109. PROBLEMS IN MOTIVATION.—Discussion of current research and concepts within the field of motivation. Once a week; two hours; second semester. *One unit.* Professor YOUNG.

115. ADVANCED CHILD PSYCHOLOGY.—Critical evaluation of research methods and findings; practice in selected techniques of child study including experimental and clinical approaches. Once a week; two hours; second semester. *One unit.*

120. PERSONNEL PSYCHOLOGY IN BUSINESS AND INDUSTRY.—The application of psychological principles and procedures to personnel methods in industry and business. Once a week; two hours; first semester. *One unit.* Associate Professor HARRELL.

123. PRACTICE IN INDUSTRIAL PSYCHOLOGY.—Intensive practice on projects in the Department of Nonacademic Personnel. Once a week; arrange; both semesters. *One unit.* Associate Professor HARRELL.

126. TEST CONSTRUCTION.—A systematic development and critical consideration of the theories, methods, and techniques in test construction. Once a week; two hours; second semester. *One unit.* Associate Professor MCQUITTY.

130. PSYCHOLOGICAL COUNSELING AND PSYCHOTHERAPY.—Methods of diagnosis, counseling, and remedial treatment in the psychological clinic. Includes participation under supervision in the diagnosis and treatment of cases. Once a week; two hours; second semester. *One unit.* Associate Professor COLLIER.

133. SPECIAL TECHNIQUES IN PSYCHOLOGICAL DIAGNOSIS AND THERAPY.—A critical survey of experimental, clinical, and theoretical literature, together with demonstrations of materials and procedures and an opportunity for student practice under supervision in the use of projective methods in psychological diagnosis and therapy. Once a week; two hours; second semester. *One unit.* Assistant Professor HELLMER.

140. PERSONALITY.—Once a week; two hours; first semester. *One unit.* Professor CATTELL.

144. THEORY AND PRACTICE OF STUDENT PERSONNEL WORK.—The psychological principles and techniques of student personnel work, with special reference to methods of making provision for individual differences at the college level. Supervised observation and practice in the Student Personnel Bureau. Once a week; arrange; first semester. *One unit.* Assistant Professor GILBERT.

150. THE PSYCHODYNAMICS OF SOCIAL GROUPS.—Once a week; two hours; first semester. *One unit.* (Not given in 1947-1948.) Professor CATTELL.

Courses for Graduates and Advanced Undergraduates

5. COMPARATIVE PSYCHOLOGY.—Animal behavior with particular reference to the behavior of the vertebrates. Laboratory and discussion. Three times a week; second semester. Assistant Professor MCALLISTER.

11. Learning and Problem Solving.—The description, measurement, and explanation of changes in behavior resulting from practice, memorizing, study, reasoning, and insight, and the retention of these changes. Three times a week; second semester.
17. History of Psychology.—Twice a week; first semester. (Not given in 1947-1948.) Professor Young.
18. Perception.—A survey of the experimental psychology and current theories of sensory and perceptual experience. Twice a week; second semester.
20. Viewpoints in Contemporary Psychology.—Contemporary systems; behaviorism; gestalt psychology; structural, purposive, and functional psychology. Twice a week; second semester. Professor Woodrow.
23. Abnormal Psychology.—Analytical consideration of types of behavior deviating from the normal. Three times a week; both semesters. Associate Professor Pennington.
26. Recent Experimental Problems (Psychology of Thinking).—A consideration of facts and theories based on experimental studies. Three times a week; second semester. (Not given in 1947-1948.) Assistant Professor McAllister.
34. Individual Differences.—The nature, significance, measurement, and causation of the mental differences between individuals and groups. Three times a week; second semester. Professor Woodrow.
37. Practice in Psychological Examination.—Supervised practice with children in the administration and interpretation of tests of general intelligence and special abilities. Three times a week; both semesters.
43. Student Personnel Work.—Principles and techniques in fitting education processes to the needs, interests, and abilities of the individual college student. Three times a week; first semester. Assistant Professor Ewing.
60. Psychology of Exceptional Children.—A survey from the psychological viewpoint of the various types of exceptional children. Emphasis on case studies. Three times a week; second semester. Assistant Professor Smith.
91. Psychology for Librarians.—Same as Library Science 91. The application of psychological principles and techniques to library service. Twice a week; second semester.

SOCIAL SCIENCES

Through the Division of the Social Sciences (including economics, geography, history, philosophy, political science, psychology, and sociology), a special program leading to the degree of Master of Arts in the Social Sciences is available to meet the needs of students who wish to study in several related fields within the social sciences rather than to specialize in one department, and the needs of those who contemplate teaching the social sciences. To qualify for this program a student, in addition to meeting the general requirements of the Graduate School, must have had twenty hours of undergraduate credit in the social sciences, and preparation in the particular departments within the division in which he elects to work substantially equivalent to the minor requirements of those departments. Work must be done in at least three departments within the division, or in two departments and in education. If work in education is elected, it may not exceed two units. No thesis is required, but to qualify for the degree, a student must pass a comprehensive examination.

Candidates for the degree of Master of Arts in the Teaching of Social Studies must earn four units in social studies, two units in education, and two units in electives. Requirements are (1) social studies (selected from not more than three of the following: economics, geography, history (at least 2 units),

sociology, philosophy, and political science), 4 units; (2) Education 101, Educational Philosophy, or Education 30, History of American Education, 1 unit; and (3) Education 125, Advanced Educational Psychology, 1 unit. The courses in social studies and the electives must be selected with the approval of the adviser. The electives may be in the social studies, in education, or, in exceptional cases, in other fields.

SOCIAL WELFARE ADMINISTRATION

To be admitted to graduate work in social welfare administration, students must have had at least twenty hours of work in the social sciences, preferably considerably more. Introductory courses in economics, sociology, political science, psychology, and biology or physiology should be included.

The professional degree Master of Social Work is given at the completion of two years of satisfactory graduate work, including the completion of an acceptable thesis and a written or oral examination covering the two-year program and thesis.

Courses for Graduates

40-41. Social Case Work.—Semester I: Principles of social case work. Semester II: Emphasis on interviewing, case recording, and case work problems. Once a week; both semesters. *One unit.* Associate Professor MacGregor.

45. Social Group Work I.—Purpose, characteristics, and use of social group work as a method in social work and as an experience for group members. Consideration of objectives, social groups, the group work process, and principles of program development. Once a week; second semester. *One unit.* Associate Professor Simon.

50-51. Field Work.—Provides a working knowledge of a social welfare agency and of community resources. Social Welfare Administration 40-41 must be taken either preceding or concurrently. Twice a week; fifteen hours; both semesters. *One unit.* Assistant Professors Linzer, Pruitt, Meyer.

60. Public Assistance.—Organization, programs, and problems of assistance. Once a week; first semester. *One unit.* Professor Stevenson.

61. Public Welfare Organization and Administration.—Development of public welfare services with emphasis on recent administrative problems. Once a week; second semester. *One unit.* Professor Stevenson.

63. The Law and Social Work.—The principles of law with which the social worker should become familiar, those defects in judicial administration that especially affect persons with low incomes, the sources of preventable delay and cost, the establishment of small claims and conciliation courts, the growth of legal aid societies and their work. Once a week; first semester. *One unit.* Mrs. Lehmann.

70. Community Organization.—An examination of the problem of identifying social needs in the community and of developing programs to meet them. Once a week; both semesters. *One unit.* Associate Professor Hosch.

80. Medical Lectures.—Causes, diagnosis, treatment, and effects of major diseases in terms of what the social worker should understand. Once a week; second semester. *One unit.* Dr. Birch, Dr. Lendrum, Associate Professor Hosch.

81. Psychiatric Information for Social Workers.—Information on normal personality growth and abnormal behavior, with emphasis on prevention, social implications, and treatment possibilities. Once a week; first semester. *One unit.* Dr. Jenkins.

90. Problems in Child Welfare Administration.—Consideration of methods of administering laws relating to child dependency, delinquency, and neglect. Once a week; first semester. *One unit.* Assistant Professor Pruitt.

100. Advanced Social Case Work.—Discussion of case material designed to increase skill in understanding the individual and in the formation of treatment plans. *Prerequisite:* Social Welfare Administration 40 and 41. Once a week; two hours; first semester. *One unit.* Associate Professor MacGregor.

101. Case Work with Children.—Case study of records from children's agencies, with emphasis on principles and methods utilized in working with children. Special consideration is given to parent-child relationships, child placement, and the selection and use of foster homes and institutions. *Prerequisite:* Social Welfare Administration 40 and 41. Once a week; two hours; second semester. *One unit.* Assistant Professor Pruitt.

108. Supervision in Social Case Work.—This course is designed for supervisors in the social case work field. Discussion will be focused on the content of supervision and the use of relationships in the supervisory process. Students will be given the opportunity to present problems from their own experience. Once a week; two hours; second semester. *One unit.* Associate Professor MacGregor.

110. Advanced Field Work.—Advanced field work practice in a family or child welfare agency. The minimum time required is fifteen hours a week. The course is designed to give students training in the use of social case work techniques and theory, and the opportunity to develop skill in practice under adequate supervision. A case work course must be taken concurrently. Twice a week; both semesters. *One unit.* Assistant Professors Linzer, Pruitt, Bates.

111. Advanced Field Work.—A continuation of Social Welfare Administration 110. Twice a week; both semesters. *One unit.* Assistant Professors Linzer, Pruitt, Bates.

130. History of English Philanthropy and Social Welfare.—Survey of the developments of public social service in England, with special attention to the work of individual reformers, prison reform, reform of the criminal law, growth of services for children, public education, and care of the handicapped groups. Once a week; two hours; first semester. *One-half unit.* Associate Professor Hosch.

131. History of American Philanthropy and Social Welfare.—Survey of the development of public and private social agencies in the United States. *Prerequisite:* Social Welfare Administration 130. Once a week; two hours; second semester. *One-half unit.* Associate Professor Hosch.

145. Supervision in Group Work.—A course for agency workers carrying supervisory and program administrative responsibilities. Emphasis on educative methods of supervision of staff workers and volunteers. Records and problems used as basis of discussion. First semester. *One unit.* Associate Professor Simon.

150. Research.—Preparation of thesis required of each candidate for a degree. Once a week; both semesters. *One to two units.* Professor Stevenson and staff.

160. Seminar in Public Welfare Administration.—Current problems in public welfare organization and administration will be analyzed. *Prerequisite:* Social Welfare Administration 61. Once a week; two hours; first semester. *One unit.* Professor Stevenson.

162. Social Insurance.—Social insurance legislation and administration in Europe and the United States with special reference to the experience in this country. Deals with the problems arising under the different titles of the Federal Social Security Act, with reference to current problems. Once a week; two hours; first semester. *One unit.* Mr. Borus.

180. Medical Social Information.—Survey of the need for health services. The organization and functions of existing medical care programs, public and private. Present theories and trends in respect to the social and economic aspects of public health. Once a week; two hours; second semester. *One unit.* Associate Professor Hosch.

181. Advanced Social Psychiatry.—This course is designed to further meet the needs of social workers for a background knowledge of psychopathology and psychotherapy. It includes a further consideration of mental and nervous disorders, maladjustments, and faulty patterns of personal and social integration, with emphasis upon psychodynamic factors in their origin and psychotherapeutic elements in their management. Once a week; two hours; first semester. *One unit.* Dr. Jenkins.

SOCIOLOGY

Graduate students electing sociology as their major must have had at least eight hours of undergraduate work in sociology and fifteen hours in one or more of the following subjects: philosophy, history, psychology, genetics, economics, and political science. Those who select sociology as a minor must have had at least six hours of undergraduate work in sociology.

Courses for Graduates

100. General Sociology.—Twice a week; both semesters. *One unit.* Professor Hiller.
101. Sociological Theory and Method.—Twice a week; first semester. *One unit.* Professor Znaniecki.
102. Recent Developments in Sociology.—Twice a week; second semester. *One unit.* Professor Hiller.
105. Research in Education for Marriage and the Family.—Twice a week; second semester. *One unit.* Associate Professor Timmons.
106. Urban Communities and Urbanization.—Twice a week; second semester. *One unit.* (Not given in 1947-1948.)
107. Rural Communities.—Twice a week; second semester. *One unit.* Professor Lindstrom.
108. Research in Social Effects of Poverty, Their Prevention and Treatment.—Twice a week; first semester. *One unit.* Associate Professor Timmons.
109. Research in Criminology.—Twice a week; second semester. *One unit.* Professor Taft.
112. Theory of Social Groups.—Twice a week; second semester. *One unit.* Professor Znaniecki.
114. Public Opinion.—Twice a week; both semesters. *One unit.* Professor Albig.
120. European Sociological Thought.—Twice a week; second semester. *One unit.* (Not given in 1947-1948.) Professor Znaniecki.
122. Regional Problems and Planning.—Twice a week; second semester. *One unit.* (Not given in 1947-1948.)
124. Advanced Penology.—Twice a week; first semester. *One unit.* (Not given in 1947-1948.) Professor Taft.
128. Fusion of Culture Resulting from Immigration.—Twice a week; first semester. *One unit.* Professor Hiller.
130. Sociology of International Conflict.—Twice a week; first semester. Professor Taft.
150. Seminar and Research.—The field, type, and amount of work are to be adjusted to the needs of the student in the respective graduate years. Both semesters. *One-half to three units.* Members of the department.

Courses for Graduates and Advanced Undergraduates

7. Rural Sociology.—Three times a week; second semester. Professor Lindstrom.
8. Poverty and Society.—Three times a week; first semester. Associate Professor Timmons.
9. Criminology.—Three times a week; both semesters. Professor Taft.

10. Population Problems and Human Ecology.—Three times a week; first semester. (Not given in 1947-1948.) Professor Taft.
11. Sociology of the Region.—Three times a week; second semester. (Not given in 1947-1948.)
14. Public Opinion.—Three times a week; both semesters. Professor Albig.
17. Methods of Sociological Research.—Three times a week; both semesters.
18. Recent Developments in Public Welfare Administration.—Three times a week; second semester. Associate Professor Timmons.
20. Social Progress and Social Values.—Three times a week; first semester. (Not given in 1947-1948.)
24. Penology.—Three times a week; first semester. Professor Taft.
25. Prevention and Treatment of Juvenile Delinquency.—Three times a week; second semester. Professor Taft.
27. Community Organization.—Three times a week; second semester. Associate Professor Timmons.
28. Immigration and Assimilation.—Three times a week; second semester. (Not given in 1947-1948.) Professor Hiller.
42. Primitive Societies.—Three times a week; both semesters. (Not given in 1947-1948.)
60. European Sociological Thought.—Three times a week; second semester. Professor Znaniecki.
61. Social Classes.—Three times a week; second semester. (Not given in 1947-1948.)
70. Social Relations and the International Order.—Three times a week; second semester. (Not given in 1947-1948.)
71. National Culture Societies.—Three times a week; first semester. Professor Znaniecki.
72. Social Roles.—Three times a week; first semester. Professor Znaniecki
80. Sociology of Education.—Same as Education 66. Three times a week; second semester. Professor Znaniecki.
85. Human Relations in Industry.—Three times a week; both semesters. Assistant Professor Wray.

SPANISH AND ITALIAN

(Including Portuguese)

SPANISH

Students doing graduate work for an advanced degree in Spanish must acquire a practical command of the language. Some knowledge of Italian or Portuguese is recommended. A considerable amount of parallel training in one or more other languages or literatures such as English, French, German, Greek, or Latin, is indispensable. In any case, some Latin is required of candidates for the Doctor of Philosophy degree, a reading knowledge of simple Latin prose being the desirable minimum.

Candidates for the degree of Master of Arts in the Teaching of Spanish must earn four units in Spanish, two units in education, and two units in electives. Requirements are Spanish (middle group courses, 1 to 2 units; graduate courses, 2 to 3 units), 4 units; Education 101, Educational Philosophy, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The courses in Spanish and the electives must be selected with the approval of the adviser. The electives may be in Spanish, in education, or, in exceptional cases, in other fields.

Courses for Graduates

130a-130b. Spanish Literature in the Sixteenth Century.—Twice a week; both semesters. *One unit.* Professor Van Horne.

131a-131b. Spanish Literature in the Seventeenth Century.—Twice a week; both semesters. *One unit.* (Not given in 1947-1948.)

135a-135b. The Modern Spanish and Spanish-American Novel.—Twice a week; both semesters. *One unit.* (Not given in 1947-1948.) Professor Hamilton.

138a-138b. Latin-American Literature.—Twice a week; both semesters. *One unit.* Assistant Professor Abreu Gómez.

139a-139b. Spanish Literature in the Middle Ages.—Twice a week; both semesters. *One unit.* (Not given in 1947-1948.) Professor Van Horne.

180a-180b. Seminar in Spanish Linguistics.—Research work in Castilian and Latin-American linguistics. Twice a week; both semesters. *One unit.* (Not given in 1947-1948.) Associate Professor Kahane.

185a-185b. Old Spanish.—Twice a week; both semesters. *One unit.* Associate Professor Kahane.

195. Seminar.—Research work in special topics. Both semesters. *One to two units.* Professors Van Horne, Hamilton, Associate Professors Kahane, Oliver.

Courses for Graduates and Advanced Undergraduates

10a-10b. Survey of Spanish Literature.—Three times a week; both semesters. Assistant Professor Flores.

11a-11b. Cervantes: Don Quixote.—Twice a week; both semesters. Assistant Professor Abreu Gómez.

12a-12b. Classical Spanish Drama.—Twice a week; both semesters (Not given in 1947-1948.)

14a-14b. Phonetics and Syntax.—Twice a week, both semesters. Associate Professor Kahane.

15a. La Cultura Hispánica: España.—(In Spanish). Twice a week; first semester. (Not given in 1947-1948.) Professor Van Horne.

15b. La Cultura Hispánica: América Hispana.—(In Spanish). Twice a week; second semester. Professor Van Horne.

16. Grandes Escritores de la América Hispana.—Twice a week; first semester. (Not given in 1947-1948.)

17a-17b. Modern Spanish and Spanish-American Drama.—Twice a week; both semesters. Professor Hamilton.

18a-18b. Survey of Latin-American Literature.—Three times a week; both semesters. Assistant Professor Moser.

19a-19b. Modern Spanish and Spanish-American Novel.—Three times a week; both semesters. Professor Hamilton.

20a-20b. Lyric Poetry: Spanish and Spanish-American Lyrics.—Twice a week; both semesters. Assistant Professor Allen.

Humanities 1. Introduction to Linguistics.—Three times a week; first semester. Associate Professor Kahane.

ITALIAN

Students doing graduate work for an advanced degree in Italian must acquire a practical command of the language. Some knowledge of Spanish is recommended. A considerable amount of parallel training in one or more other languages or literatures such as English, French, German, Greek, Latin, or Portuguese, is indispensable. In any case, some Latin is required of candidates for the Doctor of Philosophy degree, a reading knowledge of simple Latin prose being the desirable minimum.

Courses for Graduates

140a-140b. Italian Literature in the Middle Ages. Petrarch, Boccaccio.—Twice a week; both semesters. *One unit.* Associate Professor Oliver.

143a-143b. ITALIAN LITERATURE IN THE RENAISSANCE.—Twice a week; both semesters. *One unit.* (Not given in 1947-1948.) Associate Professor KAHANE.

195. SEMINAR.—Research work in special topics. Both semesters. *One to two units.* Professor VAN HORNE, Associate Professors KAHANE, OLIVER.

Courses for Graduates and Advanced Undergraduates

3a-3b. DANTE: THE DIVINE COMEDY.—Twice a week; both semesters. (Not given in 1947-1948.) Assistant Professor PIETRANGELI.

4a-4b. MODERN ITALIAN LITERATURE.—Twice a week; both semesters Professor VAN HORNE.

HUMANITIES 1. INTRODUCTION TO LINGUISTICS.—Three times a week; first semester. Associate Professor KAHANE.

PORTUGUESE

Courses for Graduates

195. SEMINAR.—Research in special topics. Both semesters. *One to four units.* Associate Professor KAHANE, Assistant Professors MOSER, ALLEN.

Courses for Graduates and Advanced Undergraduates

10a-10b. INTRODUCTION TO BRAZILIAN AND PORTUGUESE LITERATURE.—Three times a week; both semesters. Assistant Professor ALLEN.

HUMANITIES 1. INTRODUCTION TO LINGUISTICS.—Three times a week; first semester. Associate Professor KAHANE.

SPEECH

Students who enter on graduate work with speech as their major must give evidence of their ability to write good English, and must present the equivalent of fourteen hours of undergraduate work in speech.

Students making speech their minor may be admitted to such courses as in the judgment of the instructor in charge they are qualified to pursue.

Degree of Master of Arts in Speech. — Candidates for the degree of Master of Arts in Speech, in addition to complying with the general rules of the Graduate School, must (1) pass a general examination and (2) prepare a thesis on some subject approved by the faculty.

Degree of Master of Arts in the Teaching of Speech. — Candidates for the degree of Master of Arts in the Teaching of Speech must earn, if they are majoring in public speaking, four units in speech, one of which is an elective, two units in education, and two units in electives. Requirements are Speech 121a, 1 unit; Speech 121b, 1 unit; Speech 26, 1 unit; Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The elective courses in speech and the other electives must be selected with the approval of the adviser. The electives may be in speech, in education, or, in exceptional cases, in other fields.

Candidates for the degree of Master of Arts in the Teaching of Speech must earn, if they are majoring in theatre arts, four units in speech, two units in education, and two units in electives. Requirements are Speech 22, 1 unit; Speech 116, 1 unit; Speech 21, 1 unit; Speech 111, 1 unit; Education 101, Philosophy of Education, or Education 30, History of American Education, 1 unit; and Education 125, Advanced Educational Psychology, 1 unit. The electives must be

selected with the approval of the adviser. The electives may be in speech, in education, or, in exceptional cases, in other fields.

Degree of Master of Science in Speech Correction. — For graduate standing in the curriculum for the degree of Master of Science in Speech Correction, the following prerequisites are necessary: fourteen hours of speech, including courses in lip reading, speech correction, and clinical practice; courses in general psychology, child psychology, and clinical psychology; eight hours of physiology, including a course in the physiology of the nervous system and the special senses; courses in education sufficient to meet requirements for an Illinois Teacher's Certificate.

Candidates for the degree must earn 8 units as follows:

(1) Speech, 4 units, including Speech 101, 114a-114b, 117.

(2) Education, 2 units, including Education 101, Philosophy of Education, or Education 30, History of American Education; Education 125, Advanced Educational Psychology.

(3) Physiology, ½ to 1 unit, chosen from the following: Physiology 6, Advanced Mammalian Physiology; Physiology 14, Anatomy, Physiology, and Pathology of the Speech Mechanism and Ear; Physiology 43, Endocrinology.

(4) Psychology, ½ to 1 unit, chosen from the following: Psychology 37, Practice in Psychological Examination; Psychology 60, Psychology of Exceptional Children; Psychology 106, Neural Theory of the Psychological Functions; Psychology 115, Advanced Child Psychology; Psychology 130, Psychological Counseling and Psychotherapy.

(5) Electives recommended: Education 42, 115, 121, 136; Speech 15, 23, 119; Social Welfare Administration 40, 80, 81; Zoology 25, 120. Under special circumstances, other courses may be substituted with the approval of the adviser.

Courses taken at the undergraduate level may not be repeated for graduate credit in the fifth year.

Courses for Graduates

101. Research in Special Topics.—Open to candidates for the master's degree in speech. Both semesters. *One to two units.* Professors Wallace, Parrish, Associate Professors Nelson, Swanson, Assistant Professors Windesheim, Hultzén.

111. Seminar in Play Production.—Twice a week; second semester. *One unit.* Associate Professor Swanson.

114a-114b. Seminar in Speech Correction.—Twice a week; both semesters. *One unit.* Associate Professor Nelson.

116. Seminar in Play Directing.—Twice a week; first semester. *One unit.* Associate Professor Swanson.

117. Diagnosis of Speech Disorders.—Once a week; two hours; second semester. *One unit.* Associate Professor Nelson.

119a-119b. Seminar in Speech Science.—Problems in the physics and physiology of speech. Twice a week; both semesters. *One unit.* Assistant Professor Windesheim.

121a-121b. History of Rhetorical Theory.—Twice a week; both semesters. *One unit.* Professor Parrish.

Courses for Graduates and Advanced Undergraduates

14a-14b. Methods of Speech Correction.—Three times a week; both semesters. Associate Professor Nelson.

Clinical Speech Practice 1-2.—Case work in remedial speech. Must be taken concurrently with Speech 14a-14b. Three times a week; both semesters. Associate Professor Nelson.

15. Methods of Teaching Speech to the Deaf.—Three times a week; second semester. Miss Quinn.
17. Advanced Interpretation.—Three times a week; second semester. Professor Parrish.
18. Pronunciation.—Methods of voice improvement; the sounds of English studied by means of the International Phonetic Alphabet. Three times a week; first semester. Professor Parrish.
19. Speech Science.—Principles of physics involved in the production of speech sounds. Three times a week; first semester. Assistant Professor Windesheim.
20. Speech Science.—Physiology and psychology of human speech. Three times a week; second semester. Assistant Professor Windesheim.
21. Theories of Play Production.—Three times a week; second semester. Associate Professor Swanson.
22a-22b. History of the Theatre.—The theatre and the theatre arts from 1576 to 1900, with special reference to the English-speaking theatre. Three times a week; first semester. Assistant Professor Shattuck.
23. Audiometry.—Selective and diagnostic tests of hearing. Three times a week; first semester. Miss Quinn.

THEORETICAL AND APPLIED MECHANICS

Graduate students electing theoretical and applied mechanics as their major must have had the equivalent of the undergraduate courses required for a bachelor's degree in general engineering. The courses open to seniors may be taken for minor credit by graduate students whose major is in other departments.

Courses for Graduates

103. Fluid Mechanics.—Twice a week; first semester. *One unit.* Associate Professor Langhaar.
107. Laboratory Investigations in Strength of Materials.—Twice a week; both semesters. *One to two units.* Members of the department.
108. Laboratory Investigations in Hydraulics.—Twice a week; both semesters. *One to two units.* Professor Lansford.
110. Analytical Study of Experimental Work on Reinforced Concrete.—Beams, frames, and footings. Twice a week; first semester. *One unit.* Professor Richart.
111. Analytical Study of Experimental Work on Reinforced Concrete.—Columns and slabs. Twice a week; second semester. *One unit.* Professor Richart.
112. Structural Mechanics.—Three times a week; first semester. *One unit.* Professor Schwalbe.
113. Selected Topics in Structural Mechanics.—Twice a week; second semester. *One-half unit.* Professor Schwalbe.
114. Theory of Elasticity with Applications to Engineering Problems.—Three times a week; first semester. *One unit.* Professors Newmark, Myklestad.
115. Theory of Elasticity with Applications to Engineering Problems.—Continuation of 114. Twice a week; second semester. *One unit.* Professors Newmark, Myklestad.
116a. Mechanics of Materials.—Stresses and strains in members caused by various types of loads. Three times a week; first semester. *One-half to one unit.* Associate Professors Smith, Langhaar.
116b. Mechanics of Materials.—Continuation of 116a. Three times a week; second semester. *One-half to one unit.* Associate Professors Smith, Langhaar.
117. Properties of Engineering Materials.—Three times a week; both semesters. *One-half to one unit.* Associate Professor Collins.
198. Thesis.—Both semesters. *One to two units.* Members of the department.

Courses for Graduates and Advanced Undergraduates

41. Advanced Mechanics of Materials.—Three times a week; first semester. Associate Professor Smith.
42. Engineering Materials.—Three times a week; second semester. Associate Professor Collins.
43. Fluid Mechanics and Advanced Hydraulics.—Twice a week; both semesters. Professor Lansford.
44. Advanced Laboratory Work in Testing Materials.—Twice a week; second semester. Professor Putnam.
47. Engineering Analysis.—Three times a week; first semester. Professor Myklestad.
48. Engineering Analysis.—Continuation of 47. Three times a week; second semester. Professor Myklestad.
49. Advanced Dynamics and Vibrations.—Three times a week; first semester. Professor Myklestad, Assistant Professor Jones.
50. Advanced Dynamics and Vibrations.—Continuation of 49. Three times a week; second semester. Professor Myklestad, Assistant Professor Jones.

VETERINARY PATHOLOGY AND HYGIENE

Candidates for the degree of Master of Science or Doctor of Philosophy in veterinary pathology and hygiene must be graduates of a recognized veterinary college. Students whose major is in related fields may register for a minor in this field.

Courses for Graduates

101. Laboratory Diagnostic Methods in Veterinary Pathology.—Diagnosis of animal diseases caused by bacteria, filtrable viruses, and fungi. Two to three times a week; first semester. *One-half to one unit.* Professor Graham, Associate Professor Levine.
102. Laboratory Diagnostic Methods in Veterinary Pathology.—Diagnosis of animal diseases caused by parasitic protozoa, helminths, arthropods, metabolic disturbances, and poisonous plants. Twice a week; second semester. *One-half to one unit.* Professor Sampson, Associate Professor Levine.
103. Research.—One to three times a week; both semesters. *One to two units.* Professors Graham, Sampson, Morrill, Associate Professor Levine.
104. Seminar.—Required of all graduate students whose major is veterinary pathology and hygiene. Once a week; both semesters. *One-fourth unit.* Professor Graham, Associate Professor Levine, and staff.
105. Advanced Veterinary Pathology.—One to three times a week; first semester. *One unit.* Professors Graham, Morrill.
106. The Experimental Method in Veterinary Research.—Planning of experiments, use of controls, interpretation of results, sources of error, writing the research report. Lectures and discussion. Once a week; first semester. *One-fourth unit.* Associate Professor Levine.

ZOOLOGY AND PHYSIOLOGY

ZOOLOGY

Graduate students who choose zoology as a major must have had at least two years of undergraduate work in the subject chosen, except that under special circumstances advanced courses in closely allied subjects may be accepted in place of the fourth semester. Graduate students in other departments who choose

zoology as a minor must have had at least one year of undergraduate work in that subject or ten hours of any laboratory science.

A reading knowledge of German and French is indispensable for graduate study in zoology, and familiarity with Latin and Greek is of great advantage.

Graduate students whose major is zoology are strongly advised to study at least one summer at a marine biological station. Every candidate for the Doctor of Philosophy degree in zoology is required to furnish evidence of having completed satisfactorily at least six weeks of work at an approved marine biological station.

Although no special degree in wildlife management is offered, students may prepare themselves for that type of work by selecting courses from the following list: Zoology 11, 17, 18, 19, 26, 31, 109, 110, 111, 118, 131, and research courses. Such students should choose their minors from botany, physiology, entomology, and bacteriology.

Courses for Graduates

102. Classification, Phylogeny, and Evolution of Vertebrates.—Five times a week; first semester. *One unit.* Associate Professor Hall.
103. Cytology.—Twice a week; first semester. *One unit.* Professor Adamstone.
106. Advanced Vertebrate Embryology.—Twice a week; first semester. *One unit.* (Not given in 1947-1948.)
107. Experimental Vertebrate Embryology.—Twice a week; second semester. *One unit.* (Not given in 1947-1948.)
108. Experimental Protozoology.—Twice a week; first semester. *One unit.* Professor Kudo.
109. Physiological Ecology.—Twice a week; second semester. *One-half to one unit.* (Not given in 1947-1948.) Associate Professor Kendeigh.
110. Advanced Field Ecology.—Twice a week; second semester. *One-half to one unit.* (Given in 1947-1948 and in alternate years.) Associate Professor Kendeigh.
111. Advanced Field Ecology and Wildlife Management.—Once a week; first semester. *One-half to one unit.* Associate Professor Kendeigh.
113. History of Zoology.—Twice a week; first semester. *One-half unit.* (Not given in 1947-1948.)
115. Advanced Genetics.—Twice a week; first semester. *One unit.* Assistant Professors Luce, Chase.
116. Physiological Genetics.—Twice a week; second semester. *One unit.* Assistant Professor Luce.
117. Invertebrate Taxonomy.—Twice a week; second semester. *One-half to one unit.* Professor Van Cleave.
118. Advanced Protozoology.—Twice a week; second semester. *One unit.* Professor Kudo.
120. Individual Research.—Both semesters. *One to two units.* Work may be taken in the following fields:
    - Animal Ecology, Behavior, and Wildlife Management.—Associate Professor Kendeigh.
    - Chemical Embryology.—Assistant Professor Kugler.
    - Genetics and Regeneration.—Assistant Professors Luce, Chase.
    - Helminthology and Parasitology.—Associate Professor Thomas.
    - Herpetology.—Assistant Professor Smith.
    - Histology and Cytology.—Professor Adamstone.
    - Invertebrate Zoology and Parasitology.—Professor Van Cleave, Assistant Professor Ingle.
    - Mammalogy.—Assistant Professor Hoffmeister.
    - Physiological Zoology.—Associate Professor Prosser, Assistant Professor Bishop.
    - Protozoology and Parasitology.—Professor Kudo.
    - Vertebrate Embryology.—
    - Vertebrate Zoology.—Associate Professor Hall.

131. Helminthology.—Twice a week; second semester. *One-half to one unit.* Professor Van Cleave.

Courses for Graduates and Advanced Undergraduates

3. Vertebrate Embryology.—Five times a week; both semesters. Professor Adamstone.
4. Invertebrate Zoology.—Twice a week; second semester. Professor Van Cleave, Assistant Professor Ingle.
6. Vertebrate Histology.—Twice a week; second semester. Professor Adamstone.
8. Human Protozoa.—Three times a week; second semester. Professor Kudo.
11. Animal Ecology and Geography.—Three or four times a week; first semester. Associate Professor Kendeigh.
17. Field Zoology.—Two or three times a week; first semester. Professor Van Cleave.
18. Protozoology.—Three times a week; first semester. Professor Kudo.
21a-21b. Individual Topics.—Each student who desires topic work must receive permission both from the instructor under whom he is to work and from the head of the department. Arrange; both semesters. Members of the department.
22. Advanced Vertebrate Zoology.—Two to four times a week; second semester. Associate Professor Hall.
25a. Genetics.—Lecture. Three times a week; second semester. Assistant Professor Luce.
25b. Genetics.—Laboratory. Twice a week; second semester. Assistant Professor Luce.
26. Advanced Ornithology.—Twice a week; second semester. Associate Professor Kendeigh.
27. Mammalogy.—Three times a week; first semester. (Given in 1947-1948 and in alternate years.) Assistant Professor Hoffmeister.
28. Ichthyology.—Three times a week; second semester. (Not given in 1947-1948.)
29. Limnology.—Three times a week; first semester. (Not given in 1947-1948.) Dr. Matteson.
30. Herpetology.—Three times a week; second semester. (Given in 1947-1948 and in alternate years.) Assistant Professor Smith.
31. Helminthology.—Three times a week; first semester. Associate Professor Thomas.
36. Biology for Teachers.—Same as Botany 36. Twice a week; second semester. Associate Professor Fuller.

PHYSIOLOGY

Graduate students who choose physiology as a major must have had at least two years of undergraduate work in physiology or physiological zoology, or three semesters in these studies in addition to biochemistry. Graduate students in other departments who choose physiology as a minor must have had at least one year of physiology or its equivalent or an undergradaute major in either chemistry or physics.

A reading knowledge of German and French is indispensable for graduate work in physiology.

Courses for Graduates

101. Mammalian Physiology Seminar.—Review of literature. Both semesters. *One-fourth unit.* Associate Professor Steggerda.
102. Research.—Both semesters. *One to two units.* Associate Professors Steggerda, Prosser, Melampy, Assistant Professors Taylor, Bishop.
103. Experimental Physiology.—Both semesters. *One-half to one unit.* Associate Professors Steggerda, Melampy.

104. Regulative Mechanisms in Behavior.—Lectures and reports. Twice a week; second semester. *One-half unit.* Associate Professor Melampy.
142. Advanced General Physiology.—Seminar. Topic for 1947-1948, Radiation Physiology; 1948-1949, Electrophysiology. Twice a week; first semester. *One-half unit.* Associate Professor Prosser.

Courses for Graduates and Advanced Undergraduates

6. Advanced Mammalian Physiology.—Muscle, nervous system, circulation and blood. Five times a week; first semester. Associate Professor Steggerda, Assistant Professors Taylor, Wulff.
7. Advanced Mammalian Physiology.—Respiration, digestion, excretion, endocrine glands, and temperature regulation. Five times a week; second semester. Associate Professor Steggerda, Assistant Professors Taylor, Wulff.
41. Comparative Physiology.—Five times a week; first semester. Associate Professor Prosser.
42. Cellular Physiology.—Five times a week; second semester. Associate Professor Prosser.

INDEX

Accountancy, 37
Admission, 9
Agricultural Economics, 25
Agricultural Engineering, 27
Agricultural Experiment Station, 20
Agriculture, 27
Agronomy, 28
Andersen scholarship, 21
Animal Nutrition, 30
Animal Science, 29
Architecture, 31
Art, 32
Assistantships, 22
Astronomy, 33

Bacteriology, 33
Biological Sciences, 34
Botany, 35
Business Law, 38
Business Organization and Operation, 37

Calendar, 6
Carr fellowship, 21
Ceramic Engineering, 38
Changes in study-lists, 10
Chemical Engineering, 44
Chemistry, 39
City Planning, 73
Civil Engineering, 45
Classics, 48
Commerce, 50
Courses open to graduate students, 10, 25
Credit, extramural courses, 11
  graduate courses, 12
  undergraduate courses, 10

Dairy Husbandry, 50
Degrees, application for, 13
  doctor's, 17
  master's, 12
  professional, in Education, 16
    in Engineering, 14
Dental science, graduate study, 11
Departments, heads and chairmen, 8
Deposit for printing thesis, 19
Doctor of Education degree, 16, 54
Doctor of Philosophy degree, 17
  examinations, 18, 19
  in engineering, 20
  language requirements, 18
  period of study, 18
  residence, 18
  thesis, 19
  work in other universities, 18

Economics, 51
Education, 54
  professional degrees in, 16, 54
Electrical Engineering, 57
Engineering, doctor's degree in, 20
  master's degree in, 14
  professional degrees in, 14
Engineering Experiment Station, 20
  research assistantships, 21
English Language and Literature, 59
Entomology, 62
Examinations for doctor's degree, 18, 19
Executive Faculty, 5
Expenses, 23
Extramural study, 11

Faculty, Executive, 5
Failures, 12, 14
Fees, 23
  exemption, 24
Fellowships, 20
Foreign language requirements, 13, 18
French, 62

Genetics, 63
Geography, 63
Geology, 64
German, 66
Grades, 14
Greek, 48

Heads of departments, 8
History, 67
History of Graduate School, 9
Home Economics, 69
Horticulture, 71
Humanities, 72

Italian, 96

Journalism, 73

Landscape Architecture, 73
Language requirement, doctor's degree, 18
  master's degree, 13
Latin, 49
Libraries, 22
Library Science, 75
Listeners' courses, 10

Majors, 13, 17
Master of Arts, degree of, 12
Master of Education, degree of, 16, 54
Master of Fine Arts, degree of, 12, 32, 73
Master of Music, degree of, 12, 81
Master of Science, degree of, 12
Master of Social Work, degree of, 92
Master's degree in Engineering, 14
Mathematics, 77
Mechanical Engineering, 79
Mechanics, Theoretical and Applied, 99
Medical science, graduate study, 11
Metallurgical Engineering, 80
Mining Engineering, 81
Minors, 13, 17
Miscellaneous courses, 10
Music, 81

Organization of Graduate School, 9

Pharmacy, graduate study, 11
Philosophy, 83
Physical Education, 84
Physical Sciences, 85
Physics, 85
Physiology, 102
Plant Pathology, 87
Political Science, 87
Portuguese, 97
Preliminary examinations for doctor's degree, 18
Professional degrees, in Education, 16
in Engineering, 14
Psychology, 89

Registration, 10
Residence study, 11, 18
Rhetoric, 61

Sahara fellowships and scholarships, 21
Sanitary Engineering, 45
Scholarships, 20
Seniors and graduate study, 10
Sharp scholarship, 21
Social Sciences, 91
Social Welfare Administration, 92
Sociology, 94
Spanish, 95
Speech, 97
Staff, exemption from fees, 24
students on, 11
Study-lists, changes in, 10
Summer study, 11

Teacher-education programs, 14
Theoretical and Applied Mechanics, 99
Thesis, doctor's, 19
master's, 13
Transcript fee, 24
Transfer of graduate credit, 12
Trustees, Board of, 2
Tuition, 23

Veterinary Pathology and Hygiene, 100
Vocational Agriculture, 27

Withdrawal, 12

Zoology, 100

UNIVERSITY OF ILLINOIS

Divisions of Instruction

Institute of Aeronautics
College of Agriculture
College of Commerce and Business Administration
College of Dentistry
College of Education
College of Engineering
College of Fine and Applied Arts
Graduate School
School of Journalism
Institute of Labor and Industrial Relations
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State Water Survey
State Diagnostic Laboratory (for Animal Pathology)
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For general catalog of the University, special circulars, and other information, address The Director of Admissions and Records, University of Illinois, Urbana, Illinois

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UNIVERSITY OF ILLINOIS

BULLETIN

Graduate College

URBANA DEPARTMENTS

1949

UNIVERSITY OF ILLINOIS BULLETIN

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UNIVERSITY OF ILLINOIS

BULLETIN

Graduate College

URBANA DEPARTMENTS

1949

PUBLISHED BY THE UNIVERSITY
URBANA, 1949

UNIVERSITY OF ILLINOIS

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Note: The general offices of the University are open weekdays
from 8 a.m. to 12 m. and from 1 to 5 p.m.
except Saturday afternoon

CONTENTS

Board of Trustees 2
Executive Faculty of the Graduate College 5
Calendar of the Graduate College 6
Heads of Departments and Chairmen of Committees
Administering Advanced Degrees 10
Admission 13
Character of Graduate Work 14
Registration and Program of Studies 14
Masters' Degrees 17
Degree of Doctor of Philosophy 19
Professional Degrees 23
Libraries 27
Fellowships 28
Assistantships 30
Fees and Expenses 30

Fields of Instruction

Aeronautical Engineering 33
Agricultural Economics 35
Agricultural Engineering 38
Agriculture 41
Agronomy 41
Animal Science 44
Animal Nutrition 46
Architecture 48
Art 49
Astronomy 51
Bacteriology 51
Biological Sciences 53
Botany 53
Business Organization and Operation 60
Accountancy 61
Business Law 63
Management 63
Marketing 64
Ceramic Engineering 67
Chemistry 69
Chemical Engineering 77
Civil Engineering 79
Classics 84
Greek 84
Latin 86
Commerce 87
Dairy Production 88

Economics 90
Education 97
Industrial Education 111
Electrical Engineering 112
English Language and Literature 121
English Literature 122
American Literature 125
Rhetoric and Composition 126
Entomology 126
Food Technology 129
Dairy Technology 130
French 131
Genetics 133
Geography 134
Geology 135
German 139
History 141
Home Economics 148
Horticulture 153
Humanities 157
Journalism 157
Labor and Industrial Relations 161
Landscape Architecture 164
Library Science 166
Mathematics 172
Mechanical Engineering 177
Mining and Metallurgical Engineering 182
Music 186
Philosophy 192
Physical Education 195
Physical Sciences 198
Physico-Chemical Biology 199
Physics 201
Plant Pathology 205
Political Science 207
Psychology 213
Social Sciences 218
Social Welfare Administration 218
Sociology and Anthropology 224
Spanish and Italian 226
Portuguese 230
Speech 230
Theoretical and Applied Mechanics 237
Veterinary Pathology and Hygiene 240
Zoology and Physiology 240

THE GRADUATE COLLEGE
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CALENDAR

First Semester

1948

Sept. 10, Friday—Sept. 11, Saturday..Graduate registration.
Sept. 10, Friday—Sept. 11, Saturday..File your application at 105 Administration (East) if you expect to receive the master's degree in February.
September 11, Saturday.....Latest date for registration of former students without payment of late registration fee.
September 16, Thursday.....Instruction begins.
September 25, Saturday Noon.....Latest date to apply for French examination.
October 2, Saturday Noon.....Latest date to apply for German examination.
October 7, Thursday.....Latest date for changing program card without fee.
October 8, Friday.....French examination.
October 15, Friday.....German examination.
November 1, Monday.....Latest date for preliminary examination for Ph.D. (for full residence).
November 1, Monday.....Latest date for candidates for professional engineering degrees to file statements of professional study and experience.
November 24, Wednesday, 1 P.M.....Thanksgiving vacation begins.
November 29, Monday, 1 P.M.....Thanksgiving vacation ends.
December 18, Saturday, 1 P.M.....Christmas vacation begins.
December 31, Friday.....Latest date for candidates for professional engineering degrees to submit outlines of theses.

1949

January 3, Monday, 7 A.M.....Christmas vacation ends.
January 8, Saturday Noon.....Latest date for candidates for Ph.D. degree in February to deposit theses.
January 15, Saturday Noon.....Latest date to file application for the master's degree in February.
January 15, Saturday Noon.....Latest date for candidates for the master's degree in February to deposit theses.
Jan. 17, Monday—Jan. 25, Tuesday...Semester examinations.
January 22, Saturday.....Latest date for finals for the Ph.D. degree in February
February 6, Sunday.....Commencement exercises.

Second Semester

Feb. 4, Friday—Feb. 5, Saturday.....Graduate registration.
Feb. 4, Friday—Feb. 5, Saturday.....File your application at 105 Administration (East) if you expect to receive the master's degree in June
February 5, Saturday.....Latest date for registration of former students without payment of late registration fee.
February 9, Wednesday.....Instruction begins.
February 12, Saturday.....Latest date to apply for French examination.
February 15, Tuesday.....Latest regular date for applications for fellowships 1949-1950.
February 19, Saturday.....Latest date to apply for German examination.
February 25, Friday.....French examination.

February 26, Saturday Noon.....Latest date for changing program card without fee.
March 4, Friday.....German examination.
March 19, Saturday.....Latest date for preliminary examination for Ph.D. (for full residence).
April 9, Saturday Noon.....Latest date to apply for French examination.
April 14, Thursday, 1 P.M.....Easter vacation begins.
April 18, Monday, 1 P.M.....Easter vacation ends.
April 18, Monday.....Latest date to apply for German examination.
April 22, Friday.....French examination.
April 29, Friday.....German examination.
April 29, Friday.....Honors Day. Classes dismissed 10 A.M.-Noon.
May 2, Monday.....Latest date for candidates for professional engineering degrees to deposit theses.
May 16, Monday.....Latest date for candidates for Ph.D. degree in June to deposit theses.
May 24, Tuesday.....Latest date to file applications for the master's degree in June.
May 24, Tuesday.....Latest date for candidates for the master's degree in June to deposit theses.
May 26, Thursday—June 4, Saturday..Semester examinations.
May 30, Monday.....Memorial Day. No classes.
May 31, Tuesday.....Latest date for finals for the Ph.D. degree in June.
June 13, Monday.....Commencement exercises.

1949 **Summer Session**

June 17, Friday—June 18, Saturday...Graduate registration.
June 17, Friday—June 18, Saturday...File your application at 105 Administration (East) if you expect to receive the master's degree in August or October.
June 21, Tuesday.....Instruction begins.
July 2, Saturday Noon.....Latest date to apply for French examination.
July 4, Monday.....Independence Day. No classes.
July 9, Saturday Noon.....Latest date to apply for German examination.
July 15, Friday.....French examination.
July 22, Friday.....German examination.
August 6, Saturday Noon.....Latest date to file application for the master's degree in August.
August 6, Saturday Noon.....Latest date for candidates for the master's degree in August to deposit theses.
Aug. 12, Friday—Aug. 13, Saturday...Summer session examinations.
September 15, Thursday.....Latest date for candidates for Ph.D. degree in October to deposit theses.
October 1, Saturday Noon.....Latest date to file application for the master's degree in October.
October 1, Saturday Noon.....Latest date for candidates for the master's degree in October to deposit theses.
October 1, Saturday.....Latest date for finals for Ph.D. degree in October.

1949

First Semester

Sept. 16, Friday—Sept. 17, Saturday..Graduate registration.
Sept. 16, Friday—Sept. 17, Saturday..File your application at 105 Administration (East) if you expect to receive the master's degree in February.
September 17, Saturday.....Latest date for registration of former students without payment of late registration fee.
September 22, Thursday.....Instruction begins.
October 1, Saturday Noon.....Latest date to apply for French examination.
October 6, Thursday.....Latest date for changing program card without fee
October 8, Saturday Noon.....Latest date to apply for German examination.
October 14, Friday.....French examination.
October 21, Friday.....German examination.
November 1, Tuesday.....Latest date for preliminary examination for Ph.D (for full residence).
November 1, Tuesday.....Latest date for candidates for professional engineering degrees to file statements of professiona study and experience.
November 23, Wednesday, 1 P.M.....Thanksgiving vacation begins.
November 28, Monday, 1 P.M.....Thanksgiving vacation ends.
December 21, Wednesday, 7 A.M.....Christmas vacation begins.
December 31, Saturday Noon.....Latest date for candidates for professional engineering degrees to submit outlines of theses.

1950

January 3, Tuesday, 1 P.M.....Christmas vacation ends.
January 14, Saturday Noon.....Latest date for candidates for Ph.D. degree in February to deposit theses.
January 21, Saturday Noon.....Latest date to file application for the master's degree in February.
January 21, Saturday Noon.....Latest date for candidates for the master's degree in February to deposit theses.
Jan. 23, Monday—Jan. 31, Tuesday...Semester examinations.
January 28, Saturday.....Latest date for finals for Ph.D. degree in February
February 12, Sunday.....Commencement exercises.

Second Semester

Feb. 9, Thursday—Feb. 10, Friday....Graduate registration.
Feb. 10, Friday—Feb. 11, Saturday...File your application at 105 Administration (East) i you expect to receive the master's degree in June
February 11, Saturday.....Latest date for registration of former students without payment of late registration fee.
February 14, Tuesday.....Instruction begins.
February 15, Wednesday.....Latest date for applications for fellowships, 1950 1951.
February 25, Saturday Noon.....Latest date to apply for French examination.
March 4, Saturday Noon.....Latest date to apply for German examination.
March 8, Wednesday.....Latest date for changing program card without fee
March 10, Friday.....French examination.
March 17, Friday.....German examination.

March 29, Wednesday.....Latest date for preliminary examination for Ph.D. (for full residence).
April 6, Thursday, 1 P.M.....Easter vacation begins.
April 11, Tuesday, 1 P.M.....Easter vacation ends.
April 15, Saturday Noon.....Latest date to apply for French examination.
April 22, Saturday Noon.....Latest date to apply for German examination.
April 28, Friday.....French examination.
May 1, Monday.....Latest date for candidates for professional engineering degrees to deposit theses.
May 5, Friday.....German examination.
May 5, Friday.....Honors Day. Classes dismissed 10 A.M.-Noon.
May 20, Saturday Noon.....Latest date for candidates for Ph.D. degree in June to deposit theses.
May 29, Monday.....Latest date to file application for the master's degree in June.
May 29, Monday.....Latest date for candidates for the master's degree in June to deposit theses.
May 30, Tuesday.....Memorial Day. No classes.
June 2, Friday—June 10, Saturday....Semester examinations.
June 3, Saturday.....Latest date for finals for Ph.D. degree in June.
June 18, Sunday.....Commencement exercises.

Notes

Examination in one foreign language or its equivalent must be passed before residence on second year may be counted.

Two copies of thesis are required of candidates for masters' and doctors' degrees.

Candidates for masters' degrees announce thesis subjects at beginning of second half-year of work, or after completion of four units, or at beginning of third summer session.

Candidates for Ph.D. degree announce thesis subjects within six weeks after the beginning of the third year.

Candidates for Ph.D. degree deposit theses two weeks before date of final examination.

HEADS OF DEPARTMENTS AND CHAIRMEN OF COMMITTEES ADMINISTERING ADVANCED DEGREES

*Aeronautical Engineering	Henry Sheldon Stillwell
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*Agricultural Engineering	Emil Wilhelm Lehmann
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Animal Science	Leslie Ellsworth Card
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*Art	Allen Stuart Weller (Committee Chairman)
*Astronomy	Robert Horace Baker
Bacteriology	George Ira Wallace (Acting Head)
*Biological Sciences	William Patrick Hayes (Division Chairman)
Botany	Oswald Tippo (Chairman)
Business Organization and Operation	Hiram Thompson Scovill
Accountancy	
*Management	
*Marketing	
Ceramic Engineering	Andrew Irving Andrews
Chemistry	Roger Adams
Civil Engineering	Whitney Clark Huntington
Classics	Henning Larsen (Acting Head)
Dairy Production	Glenn Wade Salisbury
Economics	Pembroke Holcomb Brown (Acting Head)
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Food Technology	Louis Bradley Howard
Dairy Technology	Paul Hubert Tracy
French	Joseph Francis Jackson
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*Offer work for master's degrees only.

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Zoology and *Physiology	Frank Bolton Adamstone (Acting Head)

* Give work for masters' degrees only.

The Graduate College

Graduate instruction is offered on the Urbana campus in the fields of learning described in this catalog. Inquiries concerning them should be directed to the Dean of the Graduate College, 105 Administration (East), University of Illinois, Urbana, Illinois. Graduate courses in medical and dental sciences and in pharmacy are offered in the Colleges of Medicine, Dentistry, and Pharmacy of the University of Illinois, located in Chicago. Bulletins describing the courses offered there, the conditions of admission, and the requirements for degrees can be obtained from the Committee on Graduate Work in Medicine, Dentistry, and Pharmacy, University of Illinois, 1853 West Polk Street, Chicago 12, Illinois. Extramural graduate courses in various fields also are offered; information concerning these may be obtained from the Dean of the Division of University Extension, 118a Illini Hall, University of Illinois, Urbana, Illinois.

Admission

Admission to the Graduate College is granted to graduates of institutions whose requirements for the bachelor's degree are substantially equivalent to those of the University of Illinois, and to applicants from other institutions as determined by the Director of Admissions and Records.

Because of the heavy enrollment in certain departments of the Graduate College, special requirements in terms of undergraduate grade averages are placed on admission to those departments. Departments making such special requirements in 1948-1949 were Architecture, Bacteriology, Chemistry, Civil Engineering, Electrical Engineering, Journalism, Mechanical Engineering, Physical Education, Physics, and Psychology.

Admission to graduate courses is granted only to persons who have had the requisite undergraduate work; students whose preparation is considered inadequate will ordinarily be required to take certain undergraduate courses without credit. A student of mature age who satisfies the Dean and the department concerned of his ability to pursue graduate work in a given field may be enrolled in particular graduate courses, without reference to a degree, and permitted to carry on such study or investigation, under the direction of a department of the University, as the department shall recommend and the Dean approve.

Application blanks for admission may be obtained from the Director of Admissions and Records of the University, 100a Administra-

tion Building. Every applicant must submit with his application for admission an official transcript of his college record. All applicants who have not previously taken a physical examination at the University must do so. The examination is given by the University Health Service without cost to the student if taken, by appointment, at any time during the registration period.

Character of Graduate Work

Graduate study may be undertaken either for the first or for both of the following purposes: (1) to enable a student to broaden his knowledge of a given field and increase his competence; (2) to develop the student's power and interest in independent research. Each candidate for an advanced degree is expected to have a wide understanding of his subject and of related fields. This can be achieved in part by pursuing course work, but an additional program of private reading and individual study is usually necessary.

Registration and Program of Studies

Registration. A graduate student must register during the registration period at the beginning of each semester (see Calendar, page 6). The registration of a *new* student will be accepted at any time, provided he is prepared to take up courses already under way for credit reduced in proportion to the length of time which has elapsed since instruction began. A *former* student who registers late (see Calendar, page 6) must pay a late registration fee of $5 and also must be prepared to take courses for credit reduced in proportion to the length of time which has elapsed since instruction began.

After a student has received his permit to enter, he can obtain his program card from the Graduate College Office, 105 Administration (East), approximately one week before registration or at any time thereafter. After the program card is obtained, the student should consult his departmental advisor (see page 10). The advisor will suggest the course of study and, in the case of a new student, will determine what deficiencies, if any, must be made up; these will be listed on a prerequisite blank. If there are no deficiencies, the advisor will so indicate on this form. After the program card has been approved by the advisor, the student will secure the signatures of the individual instructors. The program of a student who has a staff appointment or who holds a University Fellowship must be approved by the Dean of the Graduate College before his registration is completed. This signa-

ture may be obtained on the first day of registration or at any time thereafter. Program cards of other students do not require the Dean's signature.

Changes in Program Cards. A graduate student is expected to plan his work carefully with his advisor; changes in his program card during the semester should not be necessary. When a change is approved by the student's advisor, the instructors involved, and the Dean of the Graduate College, it will be permitted without fee if made within three weeks of the date of registration. After that date a fee of $1 is charged for each change.

Unit Credit for Courses. Courses offering graduate credit are numbered from 300 to 399 when they are open to advanced undergraduates and to graduate students, and are numbered 400 and above when they are open to graduate students only. (Courses numbered below 300 do not carry graduate credit.)

Graduate credit is measured in terms of units. The normal program for a full-time graduate student is four units a semester. The credit which may be earned in individual courses is indicated in the course listing, and is in some instances variable. The credit for which the student is actually registered in every specific course is entered on the student's program by his advisor and is subject to approval by the Dean of the Graduate College.

Graduate Study by College Seniors. A senior who is within five hours of a bachelor's degree, who has an excellent record, and who has been in residence at the University for at least two semesters, may retain his undergraduate status and take graduate courses for credit toward an advanced degree, provided the Dean of the Graduate College approves and signs his program card at the time of registration.

Miscellaneous Courses. A graduate student carrying a normal graduate program may elect one miscellaneous subject (that is, a course which does not give credit toward an advanced degree). If it is necessary for a graduate student to carry at the same time more than one miscellaneous subject, he may not register for a full graduate program. Courses intended to teach graduate students a reading knowledge of French or German are regarded as miscellaneous courses. A student who elects a miscellaneous course is required to register in it and do the assigned work, unless he is permitted to withdraw under the rules.

Listeners' Courses. A graduate student is permitted to attend classes as a listener, provided a card bearing the approval of his advisor and of the instructor is filed at the Graduate College Office.

A student should not enter on his program card courses which he will attend as a listener.

Graduate Programs for Students on the University Staff. Assistants and others on the University staff who engage in graduate study are permitted to carry a maximum amount of academic work determined by their terms of employment as follows:

One-quarter time employment	4 units
One-third time employment	3½ units
One-half time employment	3 units
Two-thirds time employment	2¼ units
Three-quarter time employment	2 units
Full-time employment	1 unit

Exceptions will be permitted only upon formal authorization by the Dean of the Graduate College. A student who is employed on the University staff during the summer may carry one-half as many units as he would be permitted, according to the above table, to carry during a regular semester. A student who is employed can not expect to complete his academic work as promptly as he otherwise could.

Extramural Work. A maximum of four units of graduate credit earned through extramural courses may be applied to the requirements for a master's degree. Credit earned in extramural courses may be applied to a degree beyond the master's only on specific approval of the Dean of the Graduate College at the time of registration. No credit toward an advanced degree will be allowed for correspondence courses.

Withdrawal. If a student wishes to withdraw from the University, he must obtain clearance papers at 105 Administration (East). If he wishes to drop a part of his program, he should obtain a change-of-study form at that office. No student will be permitted to drop a course during the last one-third of the term.

Graduate Study in the Summer. During the summer session, a student may take courses for graduate work toward higher degrees, subject to the residence requirements indicated below. The normal program for a summer term is two units; two and one-half units may be carried with the approval of the advisor. In no case will a student be permitted to carry more than two and one-half units.

Petitions. The normal procedures and requirements of the Graduate College are indicated in this catalog, but these may be modified occasionally for justifiable reasons. A student may petition the Dean and the Executive Faculty of the Graduate College for waivers, *but he should do so only after consultation with his advisor.* Forms may be secured at the Graduate College Office.

Masters' Degrees

Requirements. A candidate for the master's degree must satisfy residence requirements, must complete at least eight units with satisfactory grades, and must submit a thesis unless otherwise specified by his major department. Before the degree will be granted, departmental requirements must be satisfied in addition to those stipulated by the Graduate College. Departmental requirements are given in this catalog.

Grades. Grades are recorded by the following letters: A, B, C, D, E. Any student who receives two units of grade below B must complete two additional units of A or B grade to qualify for the degree. Three units of a grade below B disqualify a student as a candidate for the master's degree. A grade of E in any course in the major field precludes the conferring of a degree in the academic year in which the failure was incurred.

Residence Requirements and Work Done Elsewhere. A candidate for the master's degree is required to be in residence at least two semesters. For a possible exception see paragraph entitled, "Thesis Work on Leave of Absence" (page 18). Attendance during four summer sessions or one semester and two summer sessions is considered the equivalent of two semesters in residence.

A graduate student who has done graduate work in other approved institutions may obtain credit not to exceed four units toward the master's degree by passing examinations in that work. Admission to such examinations requires the prior approval of the Dean of the Graduate College. Such a student may complete the work for the master's degree by securing additional units while registered in the Graduate College for at least two semesters.

If it is recommended in advance by the advisor, the Graduate College may permit a student to register for work at a laboratory elsewhere offering facilities not available at Urbana, or in approved field work, with the understanding that such work will be accepted for graduate credit if completed satisfactorily. The advisor will examine the student's transcript or will examine the student directly when he returns to this campus and will then make a final recommendation to the Dean of the Graduate College concerning the credit to be given.

Majors and Minors. A candidate for a master's degree may do all his work in one field, or he may select a major and one minor, or a major and two minors, as indicated in specific cases in the latter part of this catalog. A major or minor denotes the field of knowledge of a department, or such part thereof as constitutes a separate and inde-

pendent division of that field. For a master's degree a major comprises work totaling a minimum of four units. Less than one unit of work will not satisfy the requirements for a minor.

Foreign Language. The ability to use one or more of the modern languages ordinarily studied in the undergraduate curriculum is desired for all candidates for the master's degree and is required in some lines of study. A student who wishes to go beyond the master's degree to the doctorate should take at least one of the Graduate College language examinations (or its equivalent) during the first year of graduate study; no credit will be given toward the second year of the student's work for the doctorate until he has passed at least one language examination or its equivalent.

Masters' Theses. The subject of a thesis for the master's degree must be filed at the Graduate College Office by the student before the first registration following his completion of four units of work. A student usually devotes two units of work to his thesis, and no more than three units of thesis credit may be earned except by special permission. For specific instructions with reference to the preparation and form of the thesis, the student should obtain at the Graduate College Office a copy of "Instructions for the Preparation of Masters' and Doctors' Theses." Two copies of the thesis with a Certificate of Approval must be presented to the Graduate College Office, 105 Administration (East), by the date specified in the calendar of the Graduate College. (The Certificate of Approval for the master's thesis must be signed by the person under whose immediate supervision the thesis was prepared, and also by the head of the major department. These blanks may be obtained at the Graduate College Office.)

The requirement of a thesis may be waived, on the recommendation of the advisor, with the approval of the Dean, *provided application to waive the thesis is made at the time for announcing thesis subjects.* A student excused from writing a thesis must replace it with courses of instruction.

Thesis Work on Leave of Absence. A student who has completed six units of course work in residence and wishes to complete his thesis in absentia should submit a petition to the Executive Faculty. The petition must include an outline of the proposed investigation, evidence that adequate facilities for pursuing it will be available, and a statement of approval by the student's advisor.

Teacher-Education Programs. Programs leading to the master's degree in teacher education are offered to students who have satis-

factorily completed the four-year undergraduate teacher-training program. Students who have not met all of the requirements of a four-year undergraduate curriculum but who desire to take the fifth year of work for a master's degree may register, on approval of the advisor, the Coordinator of Teacher Education, and the Dean of the Graduate College. These programs are offered in the following areas, the special requirements for each being given on the pages indicated:

Agriculture — page 41
Art — page 49
Biological Sciences and General Sciences — page 53
Chemistry — page 72
Commercial Teaching — page 87
Teaching of the Deaf and Hard of Hearing — page 99
English — page 122
French — page 131
Geography — page 134
German — page 139
Home Economics — page 149
Latin — page 84
Mathematics — page 172
Mathematics and the Physical Sciences — page 172
Teaching of Mentally Handicapped Children — page 99
Music — page 186
Physical Education — page 195
Physical Sciences — page 199
Physics — page 201
Social Studies — page 218
Spanish — page 226
Speech — page 231
Speech Correction — page 231

Conferring of Degrees. Masters' degrees are conferred in February, June, August, and October. Application for the degree should be filed with the Graduate College Office at the registration period which immediately precedes the completion of the requirements for the degree. A student registered in the second semester who expects to receive his degree in the summer session should file application for his degree before May 15. Not later than one week before commencement, each candidate for an advanced degree must obtain a clearance paper from the Graduate College, 105 Administration (East). The student must obtain all the signatures called for on the form, and then return it to the Graduate College.

Degree of Doctor of Philosophy

The degree of Doctor of Philosophy is offered in the fields indicated in the portion of this catalog devoted to the individual departments. The general requirements for the degree are described below. Special departmental requirements will be found under the departmental listings.

Residence Requirements. The normal *minimum* period of study required for securing the degree of Doctor of Philosophy is three years, during which time the student must be free to devote all his working

time to his studies. All three years must be spent in resident graduate study at some accredited educational institution. A student who spends the first two years in residence at the University of Illinois may request permission to spend the last year in absentia (see Thesis Work on Leave of Absence, page 18). A student who has completed one year of graduate work elsewhere must be in residence during the two remaining years. In exceptional cases, a student with two years of graduate study elsewhere who satisfies his major department that he has completed work equivalent to the standard departmental requirements will be permitted to take his preliminary examination, provided he has fulfilled the language requirements. If such a student passes the preliminary examination, he may complete the requirements for the Doctor of Philosophy degree by devoting at least one year to research in residence. Three units of grade below B disqualify a student as a candidate for a doctor's degree.

A student may satisfy the residence requirement in part by attending summer sessions at the University of Illinois, attendance during four summer sessions being considered the equivalent of one year's residence. However, at some time during the second or third years of his doctoral program, the student must be in residence at the University through two successive semesters.

A student admitted to the Graduate College is considered a first-year student until he has met the requirements for admission to the second year. A second-year student must have completed at least eight units with satisfactory grades, and passed one foreign language examination (or its equivalent). A third-year graduate student is one who has passed the preliminary examination.

Major and Minor Subjects. A candidate for the degree of Doctor of Philosophy is required to pursue a major subject in the area of his research interest. He is also required to choose one or two minor subjects. If only one minor is chosen, it is called a "sole minor," and must be taken in an area other than that of the major. Credit for it must be earned by work representing not less than four units. If two minors are chosen, the first may be a subject closely related to the major. With the approval of the advisor, it may be a division of the major field of study; it must involve at least two units. In such a case, the second minor (not less than two units) must be taken in an area other than that of the major.

Language Examinations. As a general rule the student will be required to demonstrate his ability to read two foreign languages (usually French and German) designated by his department. Upon

approval by the Graduate College, however, the department may require demonstrated proficiency in the use of other research tools in place of one language. Information concerning individual departmental requirements may be obtained from the departmental advisor. No student will be considered as beginning his second year of graduate study until he has passed the examination in at least one of these languages (or its equivalent). The two language examinations (or their equivalent) must be passed before the student is admitted to the preliminary examination. The dates of the language examinations and the dates when application for admission to these examinations must be made are shown in the calendar at the beginning of this catalog.

Preliminary Examinations. A candidate for the doctor's degree must pass a preliminary examination intended to test his knowledge of his major and minor fields of study. He will not be admitted to this examination before (1) he has passed the two required language examinations or their equivalent, (2) he has satisfactorily completed sixteen units of graduate work, and (3) his advisor considers that he has adequate preparation in his major and minor fields. Upon the recommendation of the advisor, the Dean of the Graduate College will appoint the examining committee for the preliminary examination. This examination will be partly or entirely oral. Consult the calendar of the Graduate College (page 6) for the latest dates for preliminary examinations.

Theses. The Doctor of Philosophy is primarily a research degree; consequently, the candidate is required to demonstrate his capacity for independent research by the production of an original thesis on some topic connected with his major field of study. The subject of the thesis should be chosen by the end of the second year and must be reported to the Graduate College Office no later than six weeks after the beginning of the third year. The student shall be registered in his thesis course for the number of units corresponding to the amount of time devoted to thesis research, four units being the equivalent of full-time work.

Not later than two weeks before the time set for his final examination, and not later than four weeks before the time when he hopes to receive the degree, the candidate must submit to the Graduate College, for approval of the format, two typewritten copies of his thesis in final form, *the original on special thesis paper,* and the first carbon on plain paper, no lighter than sixteen pounds. The style and form of the thesis must comply with the regulations given in "Instructions for the Preparation of Masters' and Doctors' Theses," copies of which

may be obtained in the Graduate College Office. After the thesis has been checked at the Graduate College Office, the student must arrange that each member of the final examining committee has an opportunity to read the thesis before the date of the final examination. At the conclusion of the examination, the thesis must be deposited at the Graduate College Office.

The candidate who sustains the final examination must satisfy the publication requirements by one of the methods described below:

(A) No later than one week before Commencement, the candidate must deposit with the Graduate College one hundred printed copies of the essential part, or an abstract, or digest of his thesis, indicating the method followed, the evidence used, and the conclusions reached in the investigation. A Certificate of Approval signed by the major advisor must accompany these abstracts or be on file at the Graduate College.

(B) If the candidate expects to have his thesis accepted for publication in its entirety or in an abbreviated form by a standard journal or publisher within a year from the date of his graduation, he may pay the Bursar $75 and at the same time deposit with the Graduate College an abstract of his thesis (and the Certificate of Approval) in a condition for publication at a cost not to exceed $75.

If the thesis is accepted for publication within the year, one hundred reprints may be deposited at the Graduate College when they are available. Unless the student has made other arrangements to do this, the Graduate College will have the reprints bound with the required covers, title page, and vita, these charges being deducted from the $75 deposit. The balance of the deposit will be refunded.

If the thesis is not accepted within the year, the University will print one hundred copies of the abstract for distribution and the deposit will not be returned.

(C) The candidate may choose to have his thesis microfilmed by an approved microfilming service.

The candidate who elects this service must advise the Graduate College of his intention when he deposits his thesis or when he obtains his clearance paper from 105 Administration (East). He will pay the Bursar $35 and will deposit with the Graduate College Office the original and first carbon of his thesis and one copy of an abstract of *600 words or less.*

The Graduate College will make arrangements with the microfilming service to: (1) microfilm the thesis and obtain one positive print for the University Library; (2) print the abstract in the next issue of

an abstract journal to be distributed to leading libraries here and abroad; (3) catalogue the manuscript and print and distribute library cards in accordance with the Library of Congress procedures; (4) obtain copyright protection in the name of the author.

The $35 fee is a payment for these services; it is not a deposit, and no refunds will be made to the student.

Final Examinations. When the thesis has been completed, if the major advisor so recommends, the candidate will be given his final examination by a committee appointed by the Dean of the Graduate College. A student who, in the third year of study, fails to meet the expectations of the professors in charge of his work, or in any way fails to maintain the standard of scholarship and power of research expected of him, may be refused admission to the final examination.

The final examination must be completed at least two weeks before Commencement. Consult the calendar of the Graduate College (page 6) for the latest date for the final examination. This examination is concerned primarily with the research work of the student as embodied in his thesis, but it may be much broader and extend over the whole field of study of the candidate. The intention of the final examination is to verify that the candidate has a satisfactory grasp of his major subject as a whole, and a general acquaintance with the fields of knowledge represented by his course of study.

The final examination is oral and will be conducted entirely in the presence of the examining committee appointed by the Dean.

Conferring of Degrees. Doctors' degrees are conferred in February, June, and October. Not later than one week before Commencement, each candidate for an advanced degree must obtain a clearance paper from the Graduate College Office, 105 Administration (East). The student must obtain all the signatures called for on the form, and then return it to the Graduate College.

Professional Degrees

The degrees of Master of Arts, Master of Science, and Doctor of Philosophy are offered in a variety of subjects, but the basic requirements are the same regardless of the subject. In addition, the University of Illinois offers special programs of graduate study leading to professional degrees.

Education. Two professional degrees in Education are offered: Master of Education (Ed.M.) and Doctor of Education (Ed.D.). For the requirements for these degrees see Education, page 100.

Library Science. Two graduate degrees are offered in Library Science, the Master of Science and the Doctor of Library Science. For the requirements for these degrees see the instructions under Library Science, page 166.

Social Welfare Administration. For the requirements for the degree of Master of Social Work see under Social Welfare Administration, page 218.

Engineering. Two classes of degrees are open to graduates of the College of Engineering, namely, academic and professional.

The academic second degree in engineering is Master of Science, following Bachelor of Science, in civil engineering, electrical engineering, etc. This degree is conferred in accordance with the regulations described above for academic work in residence only.

The degree of Doctor of Philosophy in Engineering is offered in the following departments: Ceramic Engineering, Chemical Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering, Mining and Metallurgical Engineering, Physics, and Theoretical and Applied Mechanics. The general requirements for this degree as to preliminary education, residence, etc., are the same as in other fields of study.

The professional second degrees in engineering are as follows:

Agricultural Engineer, after B.S. in agricultural engineering.

Master of Architecture, after B.S. in architecture.

Architectural Engineer, after B.S. in architectural engineering.

Ceramic Engineer, after B.S. in ceramic engineering.

Chemical Engineer, after B.S. in chemical engineering.

Civil Engineer, after B.S. in civil engineering or in railway civil engineering.

Electrical Engineer, after B.S. in electrical engineering or in railway electrical engineering.

Engineer-Physicist, after B.S. in engineering physics.

Mechanical Engineer, after B.S. in mechanical engineering or in railway mechanical engineering.

Metallurgical Engineer, after B.S. in metallurgical engineering.

Engineer of Mines, after B.S. in mining engineering.

Professional degrees in engineering may be conferred on two classes of candidates: (1) those who have received an academic degree in engineering or in architecture from the University of Illinois; (2) those who have received an academic degree in engineering, including chemical engineering, from other institutions of equal standing and who have been members of the teaching or research staff of

the College of Engineering or Engineering Experiment Station or the Departments of Chemistry or Architecture of the University of Illinois for at least three years prior to the conferring of the professional degree.

A candidate declares his candidacy by filing with the Dean of the College of Engineering, as chairman of the committee in charge, a detailed statement covering his professional engineering experience. This statement must be made on a standard form supplied by the Dean of the College of Engineering, and must be filed not later than the first Monday in November preceding the Commencement at which the candidate expects to receive the degree. No statement of experience will be considered by the committee which does not show that the candidate has had a minimum of eight years of acceptable engineering experience after receiving the degree of Bachelor of Science, and that for at least five years he has been in responsible charge of engineering work. Responsible charge in engineering teaching may be considered as responsible charge of work. In determining the acceptability of the engineering experience of the candidate the committee will be guided by the character of his professional work and the degree of responsibility involved, and will take into consideration such evidences of professional ability and growth as may be shown by his investigation of engineering problems, and contributions to technical literature, and his membership and activity in engineering societies.

If the professional experience of the candidate is accepted, he must submit for approval, before December 31, an outline of his proposed thesis. The completed thesis, in the form prescribed in the "Instructions for the Preparation of Masters' and Doctors' Theses," must be submitted to the Dean of the College of Engineering for approval not later than May 1. Major technical reports or plans and specifications for major engineering projects conceived and designed or directed by the candidate may be submitted for approval in lieu of a thesis. The candidate must attend Commencement in order to receive the degree.

A candidate for a professional engineering degree must pay the tuition fee of $25 on being notified that his professional experience is accepted as qualifying him to enter as a candidate for the degree. No one will be enrolled as a candidate for the degree at the following Commencement who does not pay his fee at this time. When a candidate for a professional engineering degree has once been accepted and paid his fee, he is eligible to receive the degree at any time within five years, without additional fee, on completion of the requirements; provided, however, that unless he completes the requirements within

two years his name will be dropped from the list of candidates and in order to receive the degree within the five-year period he must register once more.

Libraries

The University Library's resources for advanced study and research are outstanding. Its present collections now exceed 2,185,000 volumes, all except about 100,000 volumes being located in Urbana. The remainder are held by the Library of Medical Sciences in Chicago, and the undergraduate divisions in Chicago and Galesburg.

In addition to the figures for cataloged volumes cited above, the University Library contains approximately 500,000 pamphlets, 75,000 maps, and 24,000 music scores and parts. More than 17,000 periodicals and newspapers are currently received.

Outstanding collections have been developed for a variety of fields. In the humanities, strong areas include classical literature, history, and archeology; sixteenth and seventeenth century English literature, especially the Milton-Shakespeare period; French, Italian, and Spanish literature; German literature of the sixteenth and seventeenth centuries; and comparative philology. In the fine arts, architecture, landscape architecture, and music are noteworthy.

In the social sciences, the Library's holdings are significant for western United States history, Latin American history of the Revolutionary period, Italian history, medieval and modern European history, German history for 1830-1900, Irish history, international law and relations, political science, law, economics, labor and industrial relations, and education.

For science and technology, collections of high rank are held in mathematics, chemistry, biological sciences (especially parasitology, entomology, and ornithology), physics, geology, engineering, and agriculture.

The Library's bibliographical facilities comprise a union catalog of more than 3,000,000 cards, representing titles owned by about two dozen major American and foreign libraries; printed catalogs of libraries, e.g., the Bibliothèque Nationale, British Museum, and Library of Congress; national and trade bibliographies of all countries for which such works have been issued; bibliographies of special subjects; and similar aids.

A number of departmental and divisional libraries are maintained. Following are the principal separately administered collections in the central library building: Classics; Commerce, Sociology, and Social Welfare Administration; Education, Philosophy, and Psychology;

English; Germanic and Romance Languages; History and Political Science; and Library Science.

Elsewhere on the campus are departmental libraries for the following fields: Agriculture, Architecture and Fine Arts, Chemistry, Engineering, Journalism, Landscape Architecture, Law, Mathematics, Music, Natural History (biological sciences, geology and geography), Natural History Survey (entomology and other biological sciences), and Physics.

Further facilities available for graduate students are free access to the general bookstacks, housing about 1,500,000 volumes, and 216 carrells in the bookstacks, assigned to individuals engaged in prolonged study and research. Interlibrary loan service from other institutions is provided for those engaged in research for dissertations.

Fellowships

In addition to the fellowships listed below, there are others for students in specific fields of instruction. These are listed under the departmental headings.

University Fellowships. University Fellowships are awarded each year to promising graduate students for work in any field in which the University offers a master's or doctor's degree. Fellowships carry exemption from tuition and all fees of the regular academic year, except the Hospital and Medical Service Fee of $5 a semester, during the period of the fellowship. The stipends are as follows:

First-year fellowship	$ 700
Second-year fellowship	850
Third-year fellowship	1,000

The holder of a University Fellowship is granted free tuition for the summer session following the termination of the academic year in which his fellowship was effective, if he desires to continue his studies during the summer. If the recipient has been in residence as a graduate student at the University of Illinois for one academic year, he also is granted free tuition for the summer session immediately preceding the effective date of his fellowship.

Candidates for fellowships must be graduates of the University of Illinois, or of colleges or universities having equivalent requirements for the bachelor's degree. To be eligible for a third-year fellowship an applicant must be prepared to pass the preliminary examination no later than one month following the beginning of his third year of work.

Application must be made on blanks obtained from the Dean of the Graduate College and should be submitted before February 15

of the academic year preceding that for which the fellowship is desired. An application received later than February 15 will not be considered until after April 15.

A person appointed is notified on April 1, and must send the Secretary of the Board of Trustees notice of his acceptance or refusal by April 15. If he accepts, he must agree that the appointment will not be resigned to take a similar one at any other institution during the year for which it is awarded, that he will not engage in any outside employment for remuneration, and that, without the consent of the University, he will neither attempt to hold concurrently any other fellowship carrying a stipend, nor abandon the appointment during the year.

A limited number of University Fellowships are awarded for the second semester. Applications for such fellowships must be received no later than December 1.

Nonresident Fellowships. A limited number of nonresident special fellowships may be awarded to exceptional graduate students for the purpose of enabling them to make direct observations or to do archival work away from the University in accordance with a plan approved by the major departments concerned. An applicant for such a fellowship will be required to appear in person before the Graduate College Fellowship Committee to explain his proposed plan for the use of the fellowship. Applicants should apply for these fellowships by February 15, although it may be possible to consider applications at other times during the year. The stipend for such fellowships will vary in accordance with the particular project, with a maximum stipend of $2,400 a year.

Resident Post-Doctoral Fellowships. A limited number of post-doctoral fellowships carrying a stipend of $2,400 a year may be provided. These fellowships are intended to provide opportunities for further training and development for outstanding students of great originality who wish to make additional use of the research facilities of the University after receiving the doctor's degree. The recipient must enter upon the fellowship within one year of the time when he received the doctorate. An applicant must submit a detailed program of research or study which he has conceived and formulated himself, and he will be interviewed by the Graduate College Fellowship Committee. Applicants should apply for this fellowship by February 15, although it may be possible to consider them also at other times during the year.

Industrial Fellowships. Fellowships for graduate students in Chemistry, Geology, Electrical Engineering, and other departments are

provided by gifts to the University made by various industrial or scientific corporations. Such fellowships are not listed here; information concerning them may be obtained from the student's major advisor. Industrial fellowships are ordinarily not offered to new students.

Wright Fellowships. Through the generous bequest of Harry G. Wright and Harriette A. Wright, a number of Wright Fellowships are awarded annually to exceptional students expressing a desire to work in agriculture or in fields closely related thereto, preference being given to residents of Illinois if their qualifications in other respects are equal to residents of other states. The Wright Fellowships carry the same stipends as the University Fellowships, and the same procedures apply.

Booth Fellowships. The Charles H. Booth Fellowships are awarded to exceptional students in agriculture. In general, the stipend is the same as for University Fellowships, and the same procedures apply.

Strong Fellowship. The Henry Strong Fellowship is awarded annually to an exceptional student in physics, chemistry, or engineering subjects who is not over twenty-five years of age. This fellowship carries the same stipend as a University Fellowship, the principal portion of the stipend being provided by the Henry Strong Educational Foundation. The same procedures apply as for the University Fellowships.

Assistantships

A number of teaching or research assistantships are available for graduate students. Application should be made to the head of the department in which the assistantship is desired. Students wishing to obtain assistantships beginning in September should apply to the department head concerned before the preceding January 15. The normal salary is $2,400 a year for a full-time assistant; most assistantships are on a part-time basis, the largest number being half-time appointments at $1,200 a year. Assistants must carry a reduced study schedule as shown on page 16, but the greater length of time required for an assistant to secure the degree is somewhat compensated by an additional gain in teaching or research experience.

Fees and Expenses

Tuition Fee

Holders of fellowships or assistantships are exempted from tuition fee.

Residents of Illinois, except those holding scholarships and fellowships, pay each semester a tuition fee of.....$40.00

Nonresidents of Illinois, except those holding scholarships and fellowships, pay each semester a tuition fee of..... 80.00

Residents of Illinois registered for only two or fewer units of credit a semester pay for each unit or fraction thereof.. 12.00

Nonresidents of Illinois registered for only two or fewer units of credit a semester pay for each unit or fraction thereof..... 24.00

Students enrolled for thesis work for the master's degree on leave of absence pay a tuition fee of..... 20.00

Candidates for professional degrees in engineering pay each year a tuition fee of..... 25.00

Hospital and Medical Service Fee. All students registering for resident work, except those who are on University appointment other than fellows and scholars, or on appointment in allied surveys and laboratories on the Urbana campus, and those who are registered for not more than one unit of graduate work, pay each semester a hospital and medical service fee of..... 5.00

(A student who presents evidence of participation in any other group insurance system providing the same benefits as those covered by the University fee may petition through the office of the Dean of Students for a refund of this fee.)

Laboratory, Library, and Supply Fee. Students taking more than two units of instruction pay each semester a laboratory, library, and supply fee of..... 8.00

(Students taking two units or less pay $4 each semester. Holders of fellowships or assistantships are exempted from this fee.)

Illini Union Service Charge. All students registering for resident work, except those who are members of the University staff and others who are registered for not more than one unit of graduate work, are assessed each semester an Illini Union service charge of..... 5.00

(Holders of fellowships or assistantships are exempted from this fee.)

Late Registration Fee. Former students who register after the regular registration days in either semester pay a late registration fee of..... 5.00

(This applies to all students whether on appointment or not.)

Change of Program Fee. For every change slip issued later than noon on Monday of the fourth week following the regular registration date, the fee is..... 1.00
(This applies to all students whether on appointment or not.)

Transcript Fee. Each student who has paid all his University fees is entitled to receive, without charge, one transcript of his record. For each additional transcript the fee is..... .50

General Deposit. Each student, except persons on appointment as fellows or members of the staff of the University or of allied surveys and laboratories, must make a deposit of $5 at the time of his first registration. Chargeable against this deposit are such items as library fines for books lost or not returned when due, unreturned towels and locks, shortages in laboratory equipment and other supplies loaned to students. Whenever the balance in a student's deposit account falls below $2.50, he is required to make an additional deposit to bring it up to $5. Whatever balance remains to his credit will be returned to him after he completes the requirements for a degree or officially withdraws from the University.

Service Charge for Deferred Fees. A service charge of ten per cent of the amount of fees deferred, but not to exceed $3 a semester, is assessed for the privilege of deferring fees. If deferred fees are paid in full within ten days after registration, the service charge is refunded except that a minimum service charge of $1 is retained by the University in all cases. The general deposit of $5 (if this deposit has not been made earlier), the service charge for deferring fees, and all charges from previous semesters must be paid on the day of registration.

Exemption from Fees. A person on the academic or administrative staff of the University in any capacity, or on fellowship appointment in the Graduate College, or on permanent employment on the non-academic staff, or on appointment in the allied surveys and laboratories on the University campus, may register in University courses for which he is eligible for admission without payment of the tuition fee and the laboratory, library, and supply fee, provided his annual salary is $2,400 a year or less.

Expenses. Although personal expenses may vary a great deal, the following estimates indicate the average cost for students: Board, $12 to $15 a week; room rent, single rooms from $18 to $30 a month; double rooms from $15 to $20 a month for each person.

Fields of Instruction

Courses open to graduate students are of two classes. Those numbered from 300 to 399 are open to advanced undergraduate and graduate students. Those numbered 400 and above are open to graduate students only.

Many courses for graduate students require some measure of previous preparation. By consultation with the advisor, a student may learn whether he has had the necessary prerequisites for a particular course.

The fellowships listed below under the various fields of instruction are specifically allocated to those fields. In addition, there are other fellowships not specifically assigned (see page 28).

AERONAUTICAL ENGINEERING

The Department of Aeronautical Engineering offers graduate work leading to the degree of Master of Science in Aeronautical Engineering. The principal fields of study are aerodynamics, aircraft power plants, and aircraft structures.

The prerequisite for graduate study in aeronautical engineering is the equivalent of the undergraduate courses required at the University of Illinois for a bachelor's degree in aeronautical engineering in the branches of the subject in which graduate registration is desired. Graduate study in certain divisions of aeronautical engineering requires, as a prerequisite, the equivalent of selected courses available as electives to advanced undergraduate and graduate students at the University of Illinois. Where it is necessary, these courses must be taken before registering in the advanced courses.

Graduate students who desire to minor in aeronautical engineering must have taken mathematics through the first course in differential equations and undergraduate aeronautical engineering courses, equivalent to those offered at the University of Illinois, which are prerequisite to study in the branch of the subject in which the minor work is to be pursued. Where special cases warrant deviation from these requirements, approval from the head of the department is required.

Graduate Teaching Faculty

Professor and Head of Department: H. S. Stillwell.
Associate Professors: M. Z. Krzywoblocki, R. W. McCloy.
Assistant Professor: J. Houser.

Courses for Graduates

411. Advanced Aerodynamics of Compressible Fluids. Advanced aerodynamic theory of compressible fluids in the subsonic and supersonic velocity ranges. I; 1 unit. Mr. Krzywoblocki.

491. Thesis. Thesis in one of the fields of aeronautical engineering. I; 1 to 2 units. Mr. Houser, Mr. Krzywoblocki, Mr. McCloy, Mr. Stillwell.

492. Thesis. Thesis in one of the fields of aeronautical engineering. II; 1 to 2 units. Mr. Houser, Mr. Krzywoblocki, Mr. McCloy, Mr. Stillwell.

493. Special Problems. Theoretical and experimental investigations in the following fields: aerodynamics, aircraft power plants, aircraft structures, and aircraft components. I; 1 to 2 units. Mr. Houser, Mr. Krzywoblocki, Mr. McCloy, Mr. Stillwell.

494. Special Problems. Theoretical and experimental investigations in the following fields: aerodynamics, aircraft power plants, aircraft structures, and aircraft components. II; 1 to 2 units. Mr. Houser, Mr. Krzywoblocki, Mr. McCloy, Mr. Stillwell.

Courses for Graduates and Advanced Undergraduates

311. Aerodynamics of Perfect Fluids. Fundamental equations, plane irrotational flow, vortex flow, combination fields of flow, Kutta-Joukowski theorem, application of conformal transformation to fields of flow, particle paths, fields of flow relative to axes fixed in fluid, velocity potential, three-dimensional fields. I; 3 hours, or ½ unit. Prerequisite: Aeronautical Engineering 212. Mr. Houser.

312. Aerodynamics of Real Fluids. Characteristics of viscous and compressible fluids, including boundary layer theory, surface friction drag, turbulence, and two-dimensional subsonic and supersonic flows. II; 3 hours, or ½ unit. Prerequisite: Aeronautical Engineering 212. Mr. Krzywoblocki.

314. Airplane Performance. The performance of conventional and unconventional aircraft developed on basic physical principles with additional empirical modifications where practical. Special attention is given to problems and methods of solution found in the industry. II; 3 hours, or ½ unit. Prerequisite: Aeronautical Engineering 211. Mr. Houser.

316. Stability and Control. An introduction to dynamics of the airplane, airplane control, and airplane maneuverability. II; 3 hours, or ½ unit. Prerequisite: Aeronautical Engineering 211; Mathematics 341 or 345. Mr. Houser.

318. Airplane Propellers. Propeller blade action theory; aerodynamic propeller testing; effect of the propeller on airplane performance; blade design and stress analysis. II; 3 hours, or ½ unit. Prerequisite: Aeronautical Engineering 212; Theoretical and Applied Mechanics 221. Mr. Stillwell.

331. Combustion, Fuels, and Lubricants. A study of the phenomena of combustion and combustion calculations; characteristics of fuels and lubricants for reciprocating engines, air-breathing jets, and rockets. I; 3 hours, or ½ unit. Prerequisite: Mechanical Engineering 205. Mr. McCloy.

332. Aircraft Power Plant Design. The aerodynamic and thermodynamic design of aircraft power plants including reciprocating engines, turbo jets, pulse jets, ram jets, and rockets. II; 3 hours, or ½ unit. Prerequisite: Aeronautical Engineering 231 and 331. Mr. McCloy.

391. Special Problems. Special problems relating to the theory, design, testing, operation, maintenance, or production of airframes or aircraft power plants. I; 2 to 4 hours, or ½ to 1 unit. Prerequisite: Senior standing in engineering; consent of instructor. Mr. Houser, Mr. Krzywoblocki, Mr. McCloy, Mr. Stillwell.

392. Special Problems. Special problems relating to the theory, design, testing, operation, maintenance, or production of airframes or aircraft power plants. II; 2 to 4 hours, or ½ to 1 unit. Prerequisite: Senior standing in engineering; consent of instructor. Mr. Houser, Mr. Krzywoblocki, Mr. McCloy, Mr. Stillwell.

AGRICULTURAL ECONOMICS

Graduate students may take work in agricultural economics leading to the degrees of Master of Science and Doctor of Philosophy. Work is offered in marketing, prices, statistics, economic policies, and finance, as applied to agriculture; farm management; land economics; international comparative agriculture; and rural sociology.

Graduate training in agricultural economics provides basic training for a wide range of employment, including agricultural economic teaching, research, or extension; a wide range of federal and state positions; foreign service with private institutions; commercial marketing; professional farm management; credit with both public and private institutions; and with many private business institutions which employ men trained for positions requiring a thorough knowledge of the economics of agriculture.

Students who desire to secure degrees in agricultural economics are required to have completed either (1) a course of study equivalent to that required for the degree of Bachelor of Science in Agriculture at the University of Illinois, and including twelve hours of agricultural economics and economics, or (2) twelve hours of undergraduate economics and agricultural economics, and, in addition, at least eight hours in business organization and operation, history, political science, and sociology.

A candidate for the degree of Master of Science is required to register for at least two units in economics, including one unit of economic theory. For the degree of Doctor of Philosophy he must register for at least five units in economics, including economic theory and history of economic thought.

If approved by the Department of Agricultural Economics and the Dean of the Graduate College, the required work in economics may be treated as a part of the major field. Otherwise, the work in economics will be considered a first minor, in which case the program in that minor will require the approval of the Department of Economics (see requirements in economics for a minor in that field).

To take agricultural economics as a minor, the student must have had at least twenty hours of undergraduate work in economic and agricultural subjects.

A number of part-time staff positions both in research and teaching are maintained. These provide practical training in research and teaching while a student is pursuing his graduate training.

Graduate Teaching Faculty

Professors: H. C. M. Case (Head of Department), R. C. Ashby, R. W. Bartlett, R. R. Hudelson, P. E. Johnston, G. L. Jordan, D. E. Lindstrom, L. J. Norton, R. C. Ross, C. L. Stewart, E. J. Working.

Associate Professor: J. E. Wills.

Assistant Professors: R. A. Kelly, R. J. Mutti, A. B. Paul.

Courses for Graduates

401. International Comparative Agriculture. Agricultural and major food problems of various countries; procedures, national and international, for improved standards. I; 1 unit. Mr. Stewart.

405. Economic Policies and Programs Affecting Agriculture. Economic analysis of state, national, and international policies and programs, including proposed legislation having important bearing on the well-being of farm people. I; 1 unit. Prerequisite: One semester of graduate work or consent of department. Mr. Norton and others.

418. Land Economics. Land classification methods and principles; land tenure systems in modern societies; land deterioration and restoration as private and public problems. II; 1 unit. Mr. Stewart.

425. Farm Management Principles and Investigational Methods. Analysis of farm business records; evaluation of measures of efficiency; planning the cropping system for increased income and control of erosion; use of economic information in fitting livestock to the farm plan; efficient use of labor and power; special research problems in farm organization. I; 1 unit. Mr. Johnston.

426. Farm Management Principles and Investigational Methods. History and development of farm management in the United States; critical analysis of research methods; use of random sampling; application of selected economic principles. II; 1 unit. Mr. Johnston.

436. Problems in Marketing Agricultural Products. Factors influencing growth of markets; methods of cheapening and improving marketing processes; activities of government agencies; cooperative efforts. II; 1 unit. Prerequisite: Adequate undergraduate work in marketing. Mr. Norton and others.

441. Agricultural Prices and Statistics. Sources and methods of collection and analysis of prices and other agricultural statistics; trend fitting, linear and curvilinear multiple correlation, analysis of variance and sampling. I; 1 unit. Prerequisite: An elementary course in statistics. Mr. Working.

442. Agricultural Prices and Statistics. Prices of agricultural products in the light of their history, value theory, monetary theory, and methods of statistical analysis. II; 1 unit. Prerequisite: Agricultural Economics 441, or equivalent. Mr. Working.

477. Rural Community Organization. Same as Sociology 477. A study of rural community structure, functions, and processes, to give the student a con-

crete picture of how rural communities operate, and the forces which cause change in the group life of the people living in a rural community. I or II; 1 unit. Mr. Lindstrom.

491. Seminar. Thesis course. All graduate students whose major is agricultural economics must register in the course, but only those writing theses acceptable for graduate degrees will be given credit. I; 1 to 4 units. Mr. Case and others.

492. Seminar. Thesis course. All graduate students whose major is agricultural economics must register in the course, but only those writing theses acceptable for graduate degrees will be given credit. II; 1 to 4 units. Mr. Case and others.

493. Agricultural Economics Research. Credit is conditional on completion of acceptable report of investigation. I; ½ to 2 units. Mr. Case and others.

494. Agricultural Economics Research. Credit is conditional on completion of acceptable report of investigation. II; ½ to 2 units. Mr. Case and others.

497. Seminar in Rural Sociology. The use of the scientific method in the study of rural social problems; an analysis of methods used in rural sociological research; an analysis of problems studied in rural sociology; guidance in carrying on research in rural sociology. II; 1 unit. Mr. Lindstrom.

Courses for Graduates and Advanced Undergraduates

302. Financing Agriculture. Capital and credit needs of farmers; agencies supplying credit needs; problems of borrowers and lenders. II; 3 hours, or ½ unit. Prerequisite: Economics 102 and 103, or 108. Mr. Norton.

312. Farm Appraisals. Same as Agronomy 312. Valuation of farm real estate; soils, crops, management, buildings, drainage, land titles, prices, and taxes in relation to value. Local field trips; estimated expense, $5. II; 5 hours, or 1 unit. Prerequisite: Agronomy 201 and Agricultural Economics 120, or equivalent. Mr. Hudelson and others.

325. Advanced Farm Management. Planning the farm business for soil conservation and profit; fitting the livestock organization to the kind of crops produced and to market outlets; economic information for farm planning; measures of farm efficiency; labor and power problems. Field trips to study successful farms; estimated expense, $5. I; 3 hours, or ½ unit. Prerequisite: Agricultural Economics 120. Mr. Johnston.

331. Grain Grading and Marketing. Same as Agronomy 331 and Marketing 331. Factors affecting the quality of grain crops; standards employed in their classification and grading in the commercial market; laboratory practice in grain grading; a trip to a commercial grain grading laboratory; economic problems and market operations in grain marketing. I; 3 hours, or ½ unit. Prerequisite: Agricultural Economics 130 and Agronomy 121, or consent of instructor. Mr. Dungan, Mr. Norton.

332. Marketing Livestock. Same as Marketing 332. Livestock market practice as applied in current marketing operations. II; 2 hours, or ½ unit. Prerequi-

site: Agricultural Economics 130, Marketing 101, or consent of instructor. Mr. Ashby.

333. Marketing Horticultural Products. Same as Horticulture 333 and Marketing 333. Producing and consuming areas; transportation; refrigeration; agencies, functions, and channels of distribution; cooperatives; marketing costs and factors affecting prices; standardization, grading, and inspection; marketing news service; perishable agricultural commodity act and other regulations; attempts to control surpluses; canning and other processing; foreign trade; consumer preference and expansion of domestic markets. I; 3 hours, or ½ unit. Prerequisite: Agricultural Economics 130, Marketing 101, or 12 hours of horticulture. Mr. Kelly.

334. Marketing Dairy Products. Same as Dairy Production 334 and Marketing 334. The dairy industry in our national economy; factors affecting per capita consumption; price plans and policies; expanding markets; trade associations and labor unions; looking ahead in the milk business. Inspection trip; estimated expense, $5. II; 3 hours, or ½ unit. Prerequisite: Agricultural Economics 130, or Marketing 101, or 12 hours of dairy production or dairy technology. Mr. Bartlett.

341. Agricultural Statistics. A study of agricultural statistics and methods of statistics especially applicable to the fields of agricultural research. Students receiving credit in this course will not receive credit in Agriculture 216. I; 3 hours, or ½ unit. Mr. Jordan.

342. Agricultural Prices. A study of the factors affecting prices of agricultural products; long-time, cyclical, seasonal, and other price movements; sources of information relating to production and demand factors; government activities as they relate to prices of agricultural products and problems in price analysis and forecasting. II; 3 hours, or ½ unit. Prerequisite: Economics 102 and 103, or 108. Mr. Jordan.

AGRICULTURAL ENGINEERING

The Department of Agricultural Engineering offers graduate work leading to the degree of Master of Science in Agricultural Engineering, with options for specialization in farm machinery, farm power, soil and water engineering, structures, or rural electrification.

Candidates for the master's degree must have had the equivalent of the undergraduate curriculum in agricultural engineering required at the University of Illinois. This specifically includes basic training in theoretical and applied mechanics, and approximately twelve semester hours of advanced undergraduate design courses in civil engineering or mechanical engineering.

Graduate Teaching Faculty

Professors: E. W. Lehmann (Head of Department), D. G. Carter, R. I. Shawl.

Associate Professor: R. C. Hay.

Associate: J. H. Rasmer.

Courses for Graduates

491. Thesis. I; 1 to 2 units. Prerequisite: Graduate standing in agricultural engineering or equivalent (engineering and agricultural degrees). Graduate Staff.

492. Thesis. II; 1 to 2 units. Prerequisite: Graduate standing in agricultural engineering or equivalent (engineering and agricultural degrees). Graduate Staff.

493. Problems in Agricultural Engineering. Investigation and report on selected problems in farm machinery, farm power, rural electrification, soil and water engineering, and farm buildings. I; 1 unit. Prerequisite: Graduation in agricultural engineering at University of Illinois, or other engineering curricula, with credit in courses essential to the optional line of study; consent of head of department.

494. Problems in Agricultural Engineering. Investigation and report on selected problems in farm machinery, farm power, rural electrification, soil and water engineering, and farm buildings. II; 1 unit. Prerequisite: Graduation in agricultural engineering at University of Illinois, or other engineering curricula, with credit in courses essential to the optional line of study; consent of head of department.

Courses for Graduates and Advanced Undergraduates

332. Design of Agricultural Machinery. Survey of needs and requirements, layout of design, estimation of cost, and study of production problems. II; 3 hours, or ½ unit. Prerequisite: Mechanical Engineering 241. Mr. Ramser.

341. Farm Power. Basic theory, analysis, and testing of internal combustion engines specifically for use in farm tractors and other farm power requirements. I; 3 hours, or ½ unit. Prerequisite: Mechanical Engineering 202. Mr. Ramser.

351. Hydraulics of Soil and Water Conservation. Studies of watersheds, runoffs, cross sections of gullies; capacities of structures, terraces, and terrace outlets; design of structures; constructing terraces; machines used in erosion control; estimating costs and benefits of various methods of control. I; 3 hours, or ½ unit. Prerequisite: Civil Engineering 115; Theoretical and Applied Mechanics 232 and 234; credit or registration in Civil Engineering 250; senior standing in agricultural engineering, or consent of instructor. Mr. Hay.

361. Farm Home Planning in Relation to Function. Same as Home Economics 361. A study of farmhouse conditions, needs, and functions; basic principles and their application to planning, remodeling, and building; financial and management factors; federal, state, and private housing programs. Lectures, discussions, and problems. II; 2 hours, or ½ unit. Prerequisite: Home Economics 272, or consent of instructor. Mr. Carter.

371. Advanced Farm Structures. I; 3 hours, or ½ unit. Prerequisite: Theoretical and Applied Mechanics 221 and 223; Civil Engineering 261; senior standing. Mr. Carter.

393. Special Problems. Each student chooses a special problem for design, laboratory, or field work with special library research. I, II; 3 hours, or ½ unit. Prerequisite: Senior standing; approval of head of department.

AGRICULTURE

Candidates for the degree of Master of Science in Vocational Agriculture must earn four units in agriculture, two units in education, and two units in electives. Requirements are agriculture, 4 units; Education 400, Philosophy of Education, or Education 302, History of American Education, 1 unit; and Education 409, Advanced Educational Psychology, 1 unit. The courses in agriculture and the electives must be selected with the approval of the advisor. The electives may be in agriculture, in education, or, in exceptional cases, in other fields. The advisors for candidates for this degree are Dean R. R. Hudelson, 104 Mumford Hall, and Professor H. M. Hamlin, 103 Gregory Hall.

Courses for Graduates

400. Methods of Agricultural Research. Principles and methods of research as applied to agricultural problems; initiating, conducting, and interpreting agricultural experiments; preparation of reports and other publications; establishment and functions of state and federal experiment stations; problems of administration and supervision. Lectures, discussions, and assigned reading. I, II; ½ unit. Mr. Carroll and others.

AGRONOMY

The Department of Agronomy offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy in Agronomy. The student may specialize in soil fertility, soil physics, soil biology, plant breeding, and crop production.

Fifteen semester hours in agronomy and related subjects are prerequisite for a minor and five additional hours for a major; but students with an unusually broad and thorough training in science may be exempted from certain of these requirements.

Adequate preparation for graduate work in soils includes courses in physics, chemistry, geology, bacteriology, and mathematics; and in crops, courses in botany, chemistry, genetics, and statistics.

A candidate for the Master of Science degree must present an acceptable thesis, unless this requirement is waived by petition, and pass an oral examination.

Candidates for the Doctor of Philosophy degree must meet the general requirements of the Graduate College regarding minors, foreign languages, theses, and special examinations.

Graduate Teaching Faculty

Professors: W. L. Burlison (Head of the Department), F. C. Bauer, O. T. Bonnett, R. H. Bray, E. E. De Turk, G. H. Dungan, J. E. Gieseking, R. W. Jugenheimer, B. Koehler, O. H. Sears, C. M. Woodworth.

Associate Professor: R. F. Fuelleman.

Assistant Professors: R. S. Stauffer, E. P. Whiteside.

Courses for Graduates

401. Soils Seminar. I, II; ¼ unit. Staff.

402. Chemical Properties of Soils: Their Relation to Soil Development and Plant Growth. Chemical properties of soils and soil materials; chemical aspects of soil development; their significance as factors in crop growth and plant nutrition. Discussion and assigned reading. I; 1 unit. Prerequisite: Adequate basic soils work. Mr. De Turk.

421. Crops and Plant Breeding Seminar. I, II; ¼ unit. Graduate Staff.

422. Pasture, Range, and Soil Conservation Research. Discussion and study of data and literature pertaining to pastures, range, and soil conservation; application of research methods to the evaluation of forage species in the management and utilization of pasture and range, and to soil conservation. II; 1 unit. Prerequisite: Agronomy 121 and 321 or 322. Mr. Fuelleman.

423. Theory and Analysis of Plant Breeding Problems. Genetics of crop plants; problems in selection and hybridization. II; 1 unit. Mr. Woodworth.

424. Principles Underlying the Production of Crops. Study of crop production by consideration of vegetative and reproductive functions; water relations, respiration, factors affecting quality of seeds and other crop products, weeds, root reserves, stabilization of crop yields, and plant hormones. II; 1 unit. Prerequisite: At least enough undergraduate credits in agronomy for a minor. Mr. Burlison, Mr. Dungan.

491. Thesis (M.S. and Ph.D.). I; ½ to 4 units.

(a) Soils. Mr. Bauer, Mr. Bray, Mr. De Turk, Mr. Gieseking, Mr. Sears, Mr. Stauffer, Mr. Whiteside.

(b) Crops. Mr. Bonnett, Mr. Burlison, Mr. Dungan, Mr. Fuelleman, Mr. Jugenheimer, Mr. Koehler, Mr. Woodworth.

492. Thesis (M.S. and Ph.D.). II; ½ to 4 units.

(a) Soils. Mr. Bauer, Mr. Bray, Mr. De Turk, Mr. Gieseking, Mr. Sears, Mr. Stauffer, Mr. Whiteside.

(b) Crops. Mr. Bonnett, Mr. Burlison, Mr. Dungan, Mr. Fuelleman, Mr. Jugenheimer, Mr. Koehler, Mr. Woodworth.

493. Research (M.S. and Ph.D.). I; ½ to 4 units.

(a) Soils. Mr. Bauer, Mr. Bray, Mr. De Turk, Mr. Gieseking, Mr. Sears, Mr. Stauffer, Mr. Whiteside.

(b) Crops. Mr. Bonnett, Mr. Burlison, Mr. Dungan, Mr. Fuelleman, Mr. Jugenheimer, Mr. Koehler, Mr. Woodworth.

494. Research (M.S. and Ph.D.). II; ½ to 4 units.

(a) Soils. Mr. Bauer, Mr. Bray, Mr. De Turk, Mr. Gieseking, Mr. Sears, Mr. Stauffer, Mr. Whiteside.

(b) Crops. Mr. Bonnett, Mr. Burlison, Mr. Dungan, Mr. Fuelleman, Mr. Jugenheimer, Mr. Koehler, Mr. Woodworth.

Courses for Graduates and Advanced Undergraduates

301. Genesis, Morphology, Classification, and Geography of Soils. Factors governing and processes active in soil development; physical and chemical properties of the soil groups of the world; classification and nomenclature of soil; soil geography. Field trips to be arranged; cost not to exceed $16. II; 3 hours, or ½ unit. Prerequisite: Agronomy 201; junior standing. Mr. Whiteside.

302. Role of Microorganisms in Soil Fertility. Microorganisms of the soils in relation to fertility; nitrogen fixation, assimilation, and preservation. I; 3 hours, or ½ unit. Prerequisite: Agronomy 201. Mr. Sears.

303. Soil Productivity, Its Variation, Modificaton, and Conservation. Factors affecting soil productivity and its conservation; soil type response; influence of cropping systems, fertilizers, and management practices on productivity trends. II; 3 hours, or ½ unit. Prerequisite: Agronomy 201; senior standing. Mr. Bauer.

304. Metabolism of Soil Microorganisms. Chemistry and bacteriology of the nitrogen cycle; nitrogen fixation, nitrification, nitrate assimilation, denitrification, and synthesis of nitrogen compounds by microorganisms; relation of nitrogen to other cycles. II; 3 hours, or ½ unit. Prerequisite: Bacteriology 104 and 105, or 320; Chemistry 132; junior standing. Mr. Sears.

305. Physical Methods for Soil Conservation Studies. Physical properties of soils affecting conservation, productivity, and drainage; their investigation by field and laboratory methods. Lecture, discussion, and laboratory. I; 3 hours, or ½ unit. Prerequisite: Agronomy 201. Offered in 1949-1950 and in alternate years. Mr. Stauffer.

306. Fertilizers and Their Soil Reactions. Fertilizer sources and materials. Chemical forms of elements in the soil, reactions of fertilizers in soils, determination of fertilizer needs, soil test methods, fertilizer application. I; 3 hours, or ½ unit. Prerequisite: Agronomy 201. Mr. Bray.

307. Principles of Soil Conservation. National and local implications of soil conservation and its relation to farming systems, land management, climate, soil character, and farming operations. II; 3 hours, or ½ unit. Prerequisite: Agronomy 121 and 201; senior standing. Mr. Stauffer.

312. Farm Appraisals. Same as Agricultural Economics 312. Valuation of farm real estate; soils, crops, management, buildings, drainage, land titles, prices, and taxes in relation to value. Local field trips; estimated expense, $5. II; 5 hours, or 1 unit. Prerequisite: Agronomy 201 and Agricultural Economics 120, or equivalent. Mr. Hudelson and others.

321. Crop Production as Affected by the Environment. Response of crop plants to their habitat; study of climatic, physiographic, edaphic, and biotic factors of the environment in relation to crop growth; means by which crop hazards may be reduced. I; 3 hours, or ½ unit. Prerequisite: Agronomy 121. Mr. Dungan.

322. Forage Crops and Pastures. Lectures and discussions of roughage production, forage crop characteristics and ecology, grasslands of farm and range

... related to animal production and soil conservation. II; 3 hours, or ½ unit. Prerequisite: Agronomy 121. Mr. Fuelleman.

323. Improvement of Farm Crops by Breeding. Heredity and variation in crop plants; effects of self-fertilization and cross-fertilization; principles and results of selection and hybridization in crop improvement. I; 3 hours, or ½ unit. Prerequisite: Agronomy 121; junior standing. Mr. Leng.

324. Principles of Field Plot Experimentation. Purpose, methods, and principles of field experimentation; interpretation of results. I; 3 hours, or ½ unit. Prerequisite: Senior standing. Mr. Woodworth.

325. Corn Breeding. Principles and procedures involved in developing, testing, and production of inbred lines and hybrids; production and processing of hybrid seed corn; genetics of corn. II; 3 hours, or ½ unit. Prerequisite: Agronomy 323. Mr. Jugenheimer.

331. Grain Grading and Marketing. Same as Agricultural Economics 331 and Marketing 331. Factors affecting the quality of grain crops; standards employed in their classification and grading on the commercial market; laboratory practice in grain grading; a trip to a commercial grain grading laboratory; economic problems and market operations in grain marketing. I; 3 hours, or ½ unit. Prerequisite: Agricultural Economics 130 and Agronomy 121, or consent of instructor. Mr. Dungan, Mr. Norton.

377. Diseases of Field Crops. A study of the symptoms of the major field crop diseases, life histories of causal organisms, and methods of control. II; 3 hours, or ½ unit. Prerequisite: Botany 317 and Agronomy 121, or consent of instructor.

ANIMAL SCIENCE

(Including Animal Nutrition)

The Department of Animal Science offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy in Animal Science and in Animal Nutrition. For a major or minor for the master's degree the student may specialize in the general field of livestock or poultry production, or in the special fields of animal genetics, animal nutrition, animal physiology, or meats. For a major or minor for the doctor's degree he may specialize in animal genetics, animal nutrition, animal physiology, or in the general field of livestock production. Advanced work in poultry may be taken for a minor for the doctor's degree.

A student who wishes to register for a minor in animal science for either the master's or the doctor's degree must offer at least fifteen college credits in the field, including the principles of feeding, the principles of genetics, and livestock production and management, and he must have had an introductory course in organic chemistry. For a major a student must offer at least five additional college credits in animal science or in courses related to the major field of specialization. To qualify for graduate study in the field of meats a student must offer credit in Animal Science 104, 204, and 205, or their equivalents. Besides these general requirements a student must have had the special training required for effective graduate study in the field of his chosen major.

Students who desire to take a minor for the doctor's degree in the general

field of livestock or poultry production must take Animal Science 305 and Animal Nutrition 401 if they have not taken these courses or their equivalents during their undergraduate training. Such students registering for a major in these general fields must take in addition Animal Nutrition 402, and will find it desirable to take Animal Science 405 or 406, or both.

In the case of students with an unusually thorough training in science who wish to pursue graduate work in some special field of animal science from a non-agricultural viewpoint, the department may waive certain of the above requirements.

Attention is also directed to the advisability of including, in undergraduate preparation for graduate work in any phase of animal science or in animal nutrition, at least introductory training in French or German and in mathematics, including, or prerequisite to, statistics.

Graduate Teaching Faculty

Professors: L. E. Card (Head of Department), S. Bull, W. E. Carroll, T. S. Hamilton, W. G. Kammlade, J. L. Krider, H. H. Mitchell, E. Roberts, R. R. Snapp, H. M. Scott.

Associate Professors: B. C. Johnson, A. V. Nalbandov.

Courses for Graduates

400. Seminar. A review of current literature in the science of animal production. I, II; ½ unit. Graduate Staff.

401. Special Problems in Beef Production. A critical study of beef cattle experiments and the interpretation of their results. Intended to prepare students for positions with agricultural colleges and experiment stations and the United States Department of Agriculture. II; 1 unit. Prerequisite: Undergraduate major in animal science. Mr. Snapp.

402. Problems in Sheep and Wool Production and Research. Basic considerations in sheep and wool production and lamb feeding. Reports of research. II; ½ unit. Prerequisite: Undergraduate major in animal science including Animal Science 302, or equivalent. Mr. Kammlade.

403. Special Problems in Swine Research. A critical study and interpretation of experiments in swine feeding, breeding, and management. Intended to aid in preparing students for positions in colleges, experiment stations, and related fields. I; ½ unit. Prerequisite: Consent of instructor. Mr. Krider.

404. Special Problems in Poultry Husbandry. A discussion of research methods and findings in the field of poultry science, with some consideration of current industry problems. I; ½ unit. Prerequisite: Consent of instructor. Mr. Card.

405. Advanced Animal Genetics. Genetic theory, analysis of animal breeding problems, genetic results of selection and different systems of breeding. I; 1 unit. Mr. Roberts.

406. Physiology of Reproduction. Comparative physiology of reproduction and endocrinology of domestic and laboratory animals; fertility and sterility. Lectures and laboratory. II; 1 unit. Mr. Nalbandov.

407. Laboratory Methods in Animal Genetics. I or II; ½ to 1 unit. Mr. Roberts.

408. Laboratory Methods in Physiology of Reproduction. I or II; ½ to 1 unit. Mr. Nalbandov.

491. Thesis. Work may be taken in the following subjects: factors in livestock production, animal genetics, animal physiology, poultry, and meats. I; 1 to 4 units. Graduate Staff.

492. Thesis. Work may be taken in the following subjects: factors in livestock production, animal genetics, animal physiology, poultry, and meats. II; 1 to 4 units. Graduate Staff.

493. Research. For students desiring to do research other than on a thesis problem. Work may be taken in the following subjects: factors in livestock production, animal genetics, animal physiology, poultry, and meats. I; ½ to 2 units. Graduate Staff.

494. Research. For students desiring to do research other than on a thesis problem. Work may be taken in the following subjects: factors in livestock production, animal genetics, animal physiology, poultry, and meats. II; ½ to 2 units. Graduate Staff.

Courses for Graduates and Advanced Undergraduates

301. Beef Production. The principles of feeding and management of beef cattle; financial aspects of beef production; diseases and parasites of beef cattle; fitting cattle for show and sale. Lectures and discussions. I, II; 3 hours, or ½ unit. Prerequisite: Animal Science 102; junior standing. Mr. Snapp.

302. Sheep Production. The sheep and wool industries; principles and practices of various phases of production. II; 3 hours, or ½ unit. Prerequisite: Animal Science 102; junior standing. Mr. Kammlade.

303. Pork Production. The place of the swine enterprise on the farm; selecting, breeding, feeding, managing, and marketing of swine for greatest profit. I, II; 3 hours, or ½ unit. Prerequisite: Animal Science 102; junior standing. Mr. Krider.

304. Poultry Management. Poultry science and practice with special reference to the place of the poultry enterprise on Illinois farms. Students may register for 3 hours credit without laboratory or for 4 hours credit with laboratory. I, II; 3 or 4 hours, or ½ unit. Prerequisite: Animal Science 102; junior standing. Mr. Scott.

305. Animal Genetics. The principles of heredity and their application to the problems of breeding. II; 3 hours, or ½ unit. Prerequisite: Zoology 104, or equivalent; junior standing. Mr. Roberts.

ANIMAL NUTRITION

The Division of Animal Nutrition offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy. To qualify for graduate study in this field a student must have or acquire an adequate knowledge of organic chem-

istry and quantitative analysis, and preferably an introduction to physiology and bacteriology. It is advisable also to include in undergraduate preparation for graduate study in animal nutrition at least introductory training in French or German and in mathematics, including, or prerequisite to, statistics. Quantitative analysis is not necessary when registration is for a second minor for the master's degree.

Courses for Graduates

401. Principles of Animal Nutrition. Physical and chemical properties of nutrients; digestion and metabolism; functions and utilization of nutrients; principles involved in determining the nutritive requirements of animals. I; 1 unit. Prerequisite: Chemistry 132, 133, or 234. Mr. Hamilton.

402. Advanced Course in Animal Nutrition. A factorial study of the nutrient requirements of animals and man, and of the net nutritive values of feeds and food materials; comparative nutrition. II; 1 unit. Prerequisite: Animal Nutrition 401, or equivalent. Mr. Mitchell.

403. Laboratory Methods in Animal Nutrition. Technics of animal nutrition investigations. I, II; 1 unit. Mr. Hamilton.

404. Methods of Vitamin Assay. A study of the principles underlying chemical, biological, and microbiological methods for the assay of vitamins, and the technical procedures that have been developed for this purpose. II; ½ to 1 unit. Prerequisite: Chemistry 350; consent of instructor. Mr. Johnson.

405. Animal Nutrition Seminar. I, II; ½ unit. Prerequisite: Animal Nutrition 402, or equivalent. Mr. Mitchell.

407. Vitamins in Nutrition. Nutritional requirements for individual vitamins; physiological function; metabolism and deficiency symptoms in different species. I; 1 unit. Prerequisite: Animal Nutrition 401 or Chemistry 350, or consent of instructor. Mr. Johnson.

408. Laboratory Methods in Vitamin Nutrition. Feeding experiments designed to acquaint students with the symptoms of vitamin deficiency and with recent methods of research in vitamin nutrition. I, II; ¼ to 1 unit. Prerequisite: Animal Nutrition 407 or Chemistry 352, or consent of instructor. Mr. Johnson.

491. Thesis. I; 1 to 4 units. Mr. Hamilton, Mr. Johnson, Mr. Mitchell.

492. Thesis. II; 1 to 4 units. Mr. Hamilton, Mr. Johnson, Mr. Mitchell.

493. Research. I; ½ to 2 units. Mr. Hamilton, Mr. Johnson, Mr. Mitchell.

494. Research. II; ½ to 2 units. Mr. Hamilton, Mr. Johnson, Mr. Mitchell.

Courses for Graduates and Advanced Undergraduates

301. Introduction to Animal Nutrition. For students whose major is not animal nutrition, but who desire an introduction to the principles and practical applications of the science to animal feeding. II; 3 hours, or ½ unit. Prerequisite: Animal Science 102; Chemistry 132. Mr. Hamilton.

ARCHITECTURE

(Including Architectural Engineering)

The Department of Architecture offers graduate work leading to the degrees of Master of Science in Architecture and in Architectural Engineering. The prerequisite for graduate work in architecture is the equivalent of the undergraduate courses required for the bachelor's degree in the branches of the subjects in which registration is desired.

Graduate Teaching Faculty

Professors: T. C. Bannister (Head of Department), C. C. Briggs, A. K. Laing, E. I. Love, N. D. Morgan, R. Newcomb, C. E. Palmer.

Courses for Graduates

401. Architectural Construction. Special problems. I, II; ½ to 2 units. Prerequisite: A degree in either option offered by the Department of Architecture. Mr. Palmer.

403. Architectural Construction. Theory and design. I, II; ½ to 2 units. Prerequisite: The degree in architectural engineering offered by the Department of Architecture, or the equivalent. Mr. Morgan.

404. Architectural Design. Advanced course. I, II; 1 to 3 units. Prerequisite: The degree in architecture offered by the Department of Architecture, or the equivalent. Mr. Briggs, Mr. Love.

406. Architectural History. Special research. I, II; ½ to 2 units. Prerequisite: A degree in either option offered by the Department of Architecture. Mr. Bannister, Mr. Laing, Mr. Newcomb.

Courses for Graduates and Advanced Undergraduates

337. Architectural Design. Advanced problems in modern buildings and building groups with complex requirements. I, II; 7 hours, or 1½ units. Prerequisite: Architecture 236; senior standing in architecture. Mr. Keith, Mr. Lindsay, Mr. Love, Mr. Williams.

338. Architectural Design. Advanced problems in modern buildings and building groups with complex requirements. I, II; 7 hours, or 1½ units. Prerequisite: Architecture 337; senior standing in architecture. Mr. Keith, Mr. Lindsay, Mr. Love, Mr. Williams.

347. Theory of Structures. Analysis of framework; industrial buildings; churches; arches; deflections; the elastic theory. I, II; 5 hours, or 1 unit. Prerequisite: Architecture 246; Theoretical and Applied Mechanics 221; credit or registration in Architecture 257. Mr. Branch.

348. Advanced Structures. Theaters, assembly halls, and high buildings; continuous beams and trusses; rigid frames; statically indeterminate structures. I, II; 5 hours, or 1 unit. Prerequisite: Architecture 347; credit or registration in Architecture 358. Mr. Morgan.

358. Reinforced Concrete Design. Reinforced concrete building design; analysis of various types of modern fireproof construction. I, II; 3 hours, or ½

unit. Prerequisite: Architecture 257; credit or registration in Architecture 348. Mr. Morgan.

ART

The Department of Art offers graduate work leading to the degree of Master of Fine Arts. The prerequisite for graduate work for this degree is the equivalent of the undergraduate courses required for the Bachelor of Fine Arts degree. Prospective students expecting to do graduate work in painting are urged to submit examples of their work to the Graduate Committee of the department in advance of registration. In the event that a prospective candidate for the Master of Fine Arts degree is found to be deficient in any phase of his undergraduate training, the Departmental Graduate Committee may require the student to take such undergraduate courses as will remove such deficiency.

Degree of Master of Fine Arts in Painting. To qualify for this degree in painting, each student is required to complete satisfactorily all of the following courses to the minimum of eight units: Art 493, 1 unit; Art 491, 1 to 2 units; Art 495, 2 to 4 units; Art 497, ½ to 2 units; and two courses in Advanced Art History, 1½ units. A thesis must be submitted and approved.

Degree of Master of Fine Arts in Art History. Under some circumstances the Bachelor of Arts degree with a major in art history may be regarded as sufficient background for students desiring to do graduate work in art history. To qualify for this degree in art history, each student is required to complete satisfactorily all of the following courses to a minimum of eight units: Art 493, 1 unit; Art 491, 1 to 4 units; Art 497, ½ unit; Advanced Art History, 1½ to 3 units; and elective, 1 to 2 units. A thesis must be submitted and approved.

Degree of Master of Fine Arts in Art Education. Candidates for this degree must earn four units in art, two of which are electives, three units in education, and one unit in an elective. Requirements are Advanced Art History, 1 unit; Art 493, 1 unit; Education 350, Curriculum Problems and Trends in Art Education, 1 unit; Education 400, Philosophy of Education, or Education 302, History of American Education, 1 unit; and Education 409, Advanced Educational Psychology, 1 unit. The elective courses in art and the other electives must be selected with the approval of the advisor. The elective may be in art, in education, or, in exceptional cases, in another field.

Graduate Teaching Faculty

Professors: A. S. Weller (Chairman of Administrative Committee), C. E. Bradbury, F. J. Roos.

Associate Professors: W. F. Doolittle, J. D. Hogan, H. A. Schultz.

Assistant Professors: C. A. Dietemann, E. C. Rae.

Courses for Graduates

491. Special Problems. Individual direction in research and guidance in writing theses. I, II; 1 to 2 units. Mr. Doolittle, Mr. Rae, Mr. Roos, Mr. Schultz, Mr. Weller.

492. Special Problems. Individual direction in research and guidance in writing theses. I, II; 1 to 2 units. Mr. Doolittle, Mr. Rae, Mr. Roos, Mr. Schultz, Mr. Weller.

493. Seminar. Introduction to research. I, II; 1 unit. Mr. Doolittle, Mr. Roos, Mr. Schultz, Mr. Weller.

495. Painting Laboratory. Studio practice with concentration in one or more of the following areas: composition, portraiture, figure painting, landscape painting, and mural painting. I, II; 1 to 2 units. Mr. Bradbury, Mr. Doolittle, Mr. Hogan.

496. Painting Laboratory. Studio practice with concentration in one or more of the following areas: composition, portraiture, figure painting, landscape painting, and mural painting. I, II; 1 to 2 units. Mr. Bradbury, Mr. Doolittle, Mr. Hogan.

497. Painting Techniques and Graphic Processes. The study of materials and techniques in painting and the graphic processes. I, II; ½ to 2 units. Mr. Dietemann, Mr. Doolittle.

498. Painting Techniques and Graphic Processes. The study of materials and techniques in painting and the graphic processes. I, II; ½ to 2 units. Mr. Dietemann, Mr. Doolittle.

Courses for Graduates and Advanced Undergraduates

311. Classical Art. Architecture, painting, sculpture, and minor arts of the Greek and Roman periods. I or II; 3 hours, or ¾ unit. Prerequisite: Art 111 and 112 for art students; junior standing or consent of instructor for others. Offered in 1948-1949 and in alternate years. Mr. Rae.

312. Medieval Art. Architecture, painting, sculpture, and minor arts of the Romanesque and Gothic periods. I or II; 3 hours, or ¾ unit. Prerequisite: Art 111 and 112 for art students; junior standing or consent of instructor for others. Offered in 1949-1950 and in alternate years. Mr. Rae.

313. Italian Renaissance Art. Architecture, painting, sculpture, and minor arts of Italy during the Renaissance. I or II; 3 hours, or ¾ unit. Prerequisite: Art 111 and 112 for art students; junior standing or consent of instructor for others. Offered in 1949-1950 and in alternate years. Mr. Weller.

314. Northern Renaissance Art. Architecture, painting, sculpture, and minor arts of France, Germany, Spain, and England in the sixteenth, seventeenth, and eighteenth centuries. I or II; 3 hours, or ¾ unit. Prerequisite: Art 111 and 112 for art students; junior standing or consent of instructor for others. Offered in 1949-1950 and in alternate years. Mr. Weller.

315. Art of the Nineteenth Century. Architecture, painting, sculpture, and minor arts of the nineteenth century in France, Germany, Spain, and England. I or II; 3 hours, or ¾ unit. Prerequisite: Art 111 and 112 for art students; junior standing or consent of instructor for others. Offered in 1949-1950 and in alternate years. Mr. Roos.

316. Art of the Twentieth Century. Architecture, painting, sculpture, and minor arts of the twentieth century in France, Germany, Spain, and England. I or II; 3 hours, or ¾ unit. Prerequisite: Art 111 and 112 for art students; junior standing or consent of instructor for others. Mr. Roos.

317. American Art. Architecture, painting, sculpture, and minor arts of the colonies and the United States. I or II; 3 hours, or ¾ unit. Prerequisite:

Art 111 and 112 for art students; junior standing or consent of instructor for others. Mr. Roos.

318. Latin American Art. A study of the more important phases and periods of the visual arts of Latin America. I or II; 3 hours, or ¾ unit. Prerequisite: Art 111 and 112 for art students; junior standing or consent of instructor for others. Mr. Rae.

ASTRONOMY

The Department of Astronomy offers graduate work leading to the degree of Master of Science. The prerequisite for graduate study in astronomy is mathematics through calculus, a year's course in descriptive astronomy, and a course in college physics.

Graduate Teaching Faculty

Professor and Head of Department: R. H. Baker.

Courses for Graduates

401. Seminar. This course fulfills requirements for minors. Chiefly for graduate students in mathematics. It may be repeated. I, II; 1 unit. Prerequisite: Consent of instructor. Mr. Baker.

Courses for Graduates and Advanced Undergraduates

307. Celestial Mechanics. II; 3 hours, or 1 unit. Prerequisite: Mathematics 142. Mr. Baker.

314. Observational Astronomy. Special problems. S; 2 or 3 hours, or ½ or 1 unit. Prerequisite: Consent of instructor. Mr. Baker.

BACTERIOLOGY

The Department of Bacteriology offers graduate work leading to the Master of Science and Doctor of Philosophy degrees. Students electing bacteriology as a major for an advanced degree must have had at least ten semester hours of bacteriology and fifteen semester hours of some other physical or biological science.

Candidates for the degree of Master of Science must pass a general written comprehensive examination toward the close of the second semester of residence.

Attention is called to the following courses, some of which must be elected for advanced degrees in bacteriology: Agronomy 302, 304; Botany 372, 417, 427, 471, 473; Chemistry 326, 329, 350; Dairy Production 350, 450, 453; Horticulture 404; Veterinary Pathology and Hygiene 401, 402, 406, 493; Zoology 318, 321, 418, 419, 421.

Graduate Teaching Faculty

Professor: F. W. Tanner.

Associate Professors: G. I. Wallace (Acting Head of Department), F. M. Clark.

Assistant Professor: C. M. Wilson.

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Courses for Graduates

403. Physiology of Bacteria. Fermentation, growth, and death. I; 1 unit. Prerequisite: Thirty or forty hours of bacteriology and chemistry. Mr. Tanner.

493. Research. I; ½ to 4 units. Mr. Clark, Mr. Tanner, Mr. Wallace.

494. Research. II; ½ to 4 units. Mr. Clark, Mr. Tanner, Mr. Wallace, Mr. Wilson.

495. Discussions of Current Problems in Bacteriology. Required of all graduate students whose major is bacteriology. I; ½ unit. Prerequisite: Ten hours of bacteriology; consent of instructor. Mr. Wallace.

496. Discussions of Current Problems in Bacteriology. Required of all graduate students whose major is bacteriology. II; ½ unit. Prerequisite: Ten hours of bacteriology; consent of instructor. Mr. Wallace.

Courses for Graduates and Advanced Undergraduates

308. Food and Applied Bacteriology. Microbiology of foods; preservation, technology, analysis; food poisoning and food-borne intoxications. Laboratory, lectures, discussions, readings, and reports. II; 5 hours, or 1 unit. Prerequisite: Bacteriology 104 and 105, or 320; junior standing; consent of instructor. Mr. Clark, Mr. Tanner, Mr. Wilson.

309. Bacterial Nutrition and Vitamin Assays. Nutrition of microorganisms, bacterial nutrition, and metabolism; microbiological assays for vitamins. Lectures and laboratories. I; 3 hours, or ½ unit. Prerequisite: Bacteriology 104 and 105, or 320; 15 hours of chemistry, including organic. Mr. Clark.

310. Epidemiology. Spread and control of communicable diseases. Lectures, readings, and problems. II; 3 hours, or ½ unit. Prerequisite: Bacteriology 104 or 320; junior standing; consent of instructor. Mr. Wallace.

320. General Bacteriology. Bacteria, structure, morphology, and systematic relationships; applications of bacteriology to general sanitation, agriculture, industrial fermentations, canning, and communicable disease. Lecture and laboratory. I, II; 5 hours, or 1 unit. Students with credit in Bacteriology 104 and 105 will not be allowed credit for Bacteriology 320. Prerequisite: Two years of college chemistry; senior standing; consent of instructor. Mr. Clark.

326. Pathogenic Bacteriology. A study of the pathogenic bacteria; classification, morphology, cultural requirements, and reactions; toxins, diagnostic tests, methods of differentiation and recognition, and the diseases bacteria cause. Lecture and laboratory. I; 5 hours, or 1 unit. Prerequisite: Bacteriology 104 and 105, or 320; junior standing. Mr. Wallace.

327. Immunology and Serology. A survey of the field of immunology; prevention of disease, diagnosis, and preparation and use of biologicals in the treatment of disease. Lecture and laboratory. II; 5 hours, or 1 unit. Prerequisite: Bacteriology 326; junior standing; consent of instructor. Mr. Wallace.

BIOLOGICAL SCIENCES

Through the Division of the Biological Sciences (including bacteriology, botany, entomology, physiology, psychology, zoology) it is possible to arrange a program leading to the degree of Master of Science in the Biological Sciences. While the main emphasis is on botany and zoology, the candidate must have at least one unit in each of the following subjects: bacteriology, botany, entomology, physiology, and zoology. One unit in psychology (other than educational psychology) is strongly recommended. In planning his course of study the candidate should seek to attain the desired diversity by giving less emphasis to subjects in which he has already had considerable training. At least one unit must be taken in courses of graduate grade (courses numbered 300 and upwards). No thesis is required, but at least one course should be included in which individual problems are assigned. The chairman of the Division of Biological Sciences is Professor W. P. Hayes, 301 Harker Hall.

Candidates for the degree of Master of Science in the Teaching of the Biological Sciences and General Science must earn four units in biological sciences, two units in education, and two units in electives. Requirements are biological sciences, 4 units; Education 400, Philosophy of Education, or Education 302, History of American Education, 1 unit; and Education 409, Advanced Educational Psychology, 1 unit. The courses in the biological sciences and the electives must be selected with the approval of the advisor. The electives may be in the biological sciences, in education, or, in exceptional cases, in other fields. The advisor for candidates for this degree is Professor H. J. Fuller, 301 Natural History Building.

BOTANY

The Department of Botany offers graduate work leading to the Master of Science and Doctor of Philosophy degrees. Candidates for advanced degrees must have had at least twenty hours of undergraduate work in botany, including courses 130, 160, and 304 or 120; or fifteen hours in botany (including courses 130, 160, and 304 or 120) and five hours in a related subject acceptable to the department. Graduate students who elect botany for minor credit must have fifteen hours in botany or ten hours in botany and five hours in a related subject acceptable to the department.

The following fields are available for specialization within the department: plant morphology, plant physiology (including photosynthesis), systematic botany, mycology, plant pathology, plant ecology or plant geography, cytology, genetics, cytogenetics, and plant anatomy.

Attention is called to courses in agronomy, bacteriology, chemistry, entomology, geography, geology, horticulture, mathematics, physics, physiology, and zoology, which are available for advanced students and offer a broad foundation for botanical work. Joint majors may be arranged in botany and agronomy, or botany and horticulture.

Graduate students may avail themselves of the University Herbarium which contains some 300,000 specimens of vascular plants, bryophytes, fungi, and fossil plants. As outdoor laboratories, the University maintains two tracts of woodland, Brownfield Woods and William Trelease Woods. In addition, certain areas of the Allerton Estate near Monticello are available for research and advanced study. Several ranges of greenhouses are maintained for experimental work with living

plant materials, and laboratories well equipped for research in plant physiology including exceptional facilities for studies of photosynthesis are available for students in these fields. Recently, new laboratories of cytogenetics and genetics have been added and completely equipped. A new paleobotanical laboratory has also been installed. The College of Agriculture and the Agricultural Experiment Station offer unusual facilities to graduate students in the plant sciences. The Natural History Library with over 60,000 volumes offers excellent library facilities, with many bibliographical aids, including the Gray Herbarium Card Index of American Plants, the Index to American Botanical Literature of the Torrey Botanical Club, and the Tilden Index Algarum Universalis. In addition, the University maintains such facilities as an electron microscope, electron computer, betatron, ultra-centrifuge, and a radiocarbon laboratory for use in tracer studies.

Candidates for the master's degree in botany must take, in addition to the basic requirements listed above, one course in advanced morphology or systematic botany (Botany 320, 325, 343, 344, 345, 360, or equivalent), one course in advanced physiology or ecology (Botany 333, 335, 381, 385, 386, or equivalent), and Library Science 433. Candidates for the master's degree in botany must take an examination covering the field of general botany. This is primarily an oral examination, although, at the option of the faculty, it may include a written section. It is given during the latter part of the second semester of residence.

Candidates for the degree of Doctor of Philosophy in Botany must take, in addition to the basic requirements listed above, the following courses (or they must be responsible for their content): One course in advanced systematic botany (Botany 360, or equivalent), one course in advanced morphology (Botany 320, 325, 343, 344, or equivalent), one course in advanced physiology (Botany 333, 335, or equivalent), one course in ecology or plant geography (Botany 381, 385, 386, or equivalent), one course in genetics (Botany 322, or equivalent), one course in mycology (Botany 372, or equivalent), and one course in plant anatomy (Botany 345, or equivalent). Under special circumstances a student may petition the Botany Department to waive some of these requirements. All candidates for the Doctor of Philosophy degree in botany must pass a qualifying examination administered by the department. This examination is given during the latter part of the year which follows the award of the master's degree. It is an oral examination, but may include a written section. It covers the general field of botany including physiology, morphology, ecology, systematic botany, genetics, etc. The purposes of this examination are: (1) to determine the deficiencies of the student so that he may be advised to correct them, and (2) to determine whether the student should be advised to continue his work for the Doctor of Philosophy degree.

Some time after the qualifying examination and the two foreign language examinations are passed, the candidate is given a preliminary examination administered by a committee appointed by the Dean of the Graduate College. This examination is designed to test the candidate's knowledge of the fields of his major and minor subjects. A final examination administered by a committee appointed by the Dean of the Graduate College is given at least two weeks before the time when the degree is conferred. This examination is primarily on the student's research but need not be confined to this.

Masters' and doctors' theses are due in the office of the Department of Botany ten days before they are due in the Graduate College office. During this period theses are available for reading by faculty members, who may suggest changes to be made in theses before they are delivered to the Dean of the Graduate

College. Before writing their theses all graduate students are urged to obtain from the Graduate College office copies of "Instructions for the Preparation of Masters' and Doctors' Theses."

Students are expected to secure a broad background in the whole field of botany, as well as in general biological principles. This may be achieved in part by courses, but an essential adjunct in the acquisition of this background is a program of individual reading and individual study. The following may be cited as examples of the type of subjects for private study: history of botany, philosophy of science (the student's attention is directed to Philosophy 328, a course in the philosophy of science, which may be taken or audited), and recent developments in the various branches of botany. In addition to courses required of all candidates, the student's advisor in a special branch of botany will recommend other courses to fit the student's special needs, both in his specialty and in allied subjects. Thus, the student in physiology will be advised to take certain courses in chemistry and physics, while a student in morphology or taxonomy may be instructed to enroll in geology. Students are urged to prepare at least one research paper for publication before completing work for the doctor's degree.

Students desiring to obtain a master's degree preparatory to high school teaching and not contemplating work for the Doctor of Philosophy degree should consider registration in the graduate teacher-training curriculum leading to the Master of Science degree in the Teaching of Biological Sciences and General Science. The advisor for candidates for this degree is Professor H. J. Fuller, 301 Natural History Building.

Students who wish to major in plant pathology are referred to the section of this Catalog devoted to plant pathology.

Graduate Teaching Faculty

Professors: J. T. Buchholz, R. Emerson, E. I. Rabinowitch, M. M. Rhoades, A. G. Vestal, O. H. Warburg.

Associate Professors: O. Tippo (Chairman of Department), H. J. Fuller, G. N. Jones, L. Shanor.

Assistant Professors: J. F. Nance, W. N. Stewart, J. R. Laughnan.

Lecturer: K. B. Raper (Visiting).

Courses for Graduates

404. Plant Virology. Same as Horticulture 404 and Plant Pathology 404. Fundamental concepts; classification, symptomology; infectivity; biological, chemical, and physical properties; techniques for transmission, staining, assay, filtration, and purification; control methods; sources of information; history of virology. II; 1 unit. Prerequisite: Consent of instructor. Offered in 1949-1950 and in alternate years. Mr. Thornberry.

410. Botanical Discussions. Required of all graduate students in botany. I, II; 0 to ¼ unit. Mr. Tippo.

413. Discussions in Plant Physiology. I, II; ¼ unit. Mr. Fuller, Mr. Nance.

414. Discussions in Plant Morphology and Systematic Botany. I, II; ¼ unit. Mr. Buchholz, Mr. Jones, Mr. Stewart, Mr. Tippo.

417. Discussions in Plant Pathology. Same as Horticulture 417 and Plant Pathology 417. Required for majors in plant pathology and as elective for

graduate students in plant science. I, II; ¼ unit. Mr. Anderson, Mr. Stevens.

418. Discussions in Plant Ecology and Plant Geography. Developments in ecology and plant geography, with emphasis on one special division. II; ¼ unit. Prerequisite: Graduate standing in botany, entomology, geography, or zoology. Offered in 1948-1949 and in alternate years. Mr. Vestal.

419. Discussions in Photosynthesis and Related Topics. I, II; ¼ unit. Prerequisite: Consent of instructor. Mr. Emerson, Mr. Rabinowitch.

420. Cytogenetics. An advanced course in which emphasis is placed on the correlation of genetic data with chromosomal aberrations. I; 1 unit. Prerequisite: Botany 320 and 322, or equivalent. Mr. Rhoades.

421. Cytogenetics. An advanced course in which emphasis is placed on the correlation of genetic data with chromosomal aberrations. II; 1 unit. Prerequisite: Botany 320 and 322, or equivalent. Mr. Rhoades.

422. Discussions in Genetics and Cytogenetics. I, II; ¼ unit. Mr. Laughnan, Mr. Rhoades.

427. Discussions in Mycology. A seminar course designed for discussion of current research activities in the morphology, taxonomy, and physiology of fungi, especially the nonparasitic forms. I, II; ¼ unit. Prerequisite: Consent of instructor. Mr. Shanor.

433. Advanced Physiology of Growth, Responses, and Reproduction. I; 1 unit. Prerequisite: Botany 333, or equivalent. Offered in 1949-1950 and in alternate years. Mr. Fuller.

471. Advanced Mycology — Special Groups. Special groups of fungi and their activities are considered. Different groups for concentrated study may be selected each semester depending upon the student's interests in mycology. I, II; ½ unit. Prerequisite: Consent of instructor. Mr. Raper, Mr. Shanor.

473. Epidemiology of Plant Diseases. Same as Plant Pathology 473. I; ½ unit. Prerequisite: A major in plant science or entomology. Offered in 1948-1949 and in alternate years. Mr. Stevens.

493. Research. I; ½ to 4 units. Work may be taken in the following fields, subject to approval of one of the staff:

(a) Plant Morphology. Mr. Buchholz, Mr. Stewart.
(b) Plant Physiology. Mr. Fuller.
(c) Systematic Botany of Vascular Plants and Bryophytes. Mr. Jones.
(d) Mycology. Mr. Shanor.
(e) Plant Pathology. Mr. Anderson, Mr. Gottlieb, Mr. Koehler, Mr. Linn, Mr. Stevens, Mr. Thornberry.
(f) Plant Ecology or Plant Geography. Mr. Vestal.
(g) Plant Anatomy. Mr. Tippo.
(h) Photosynthesis. Mr. Emerson, Mr. Rabinowitch.
(i) Genetics and Cytogenetics. Mr. Rhoades.
(j) Paleobotany. Mr. Stewart.

494. Research. II; ½ to 4 units. Work may be taken in the following fields, subject to approval of one of the staff:

(a) Plant Morphology. Mr. Buchholz, Mr. Stewart.

(b) Plant Physiology. Mr. Fuller.

(c) Systematic Botany of Vascular Plants and Bryophytes. Mr. Jones.

(d) Mycology. Mr. Shanor.

(e) Plant Pathology. Mr. Anderson, Mr. Gottlieb, Mr. Koehler, Mr. Linn, Mr. Stevens, Mr. Thornberry.

(f) Plant Ecology or Plant Geography. Mr. Vestal.

(g) Plant Anatomy. Mr. Tippo.

(h) Photosynthesis. Mr. Emerson, Mr. Rabinowitch.

(i) Genetics and Cytogenetics. Mr. Rhoades.

(j) Paleobotany. Mr. Stewart.

Courses for Graduates and Advanced Undergraduates

300. Individual Topics. For seniors and first-year graduate students who wish to study individual problems and topics not assigned in other courses. Undergraduates may not offer more than 5 hours in Botany 300 and 301 toward a bachelor's degree, nor graduate students more than 1 unit in Botany 300 and 301 toward a master's degree. I; 2 to 5 hours, or ¼ to ½ unit. Prerequisite: Botany 100 and 101, or 104; 10 hours of advanced work in botany or another biological science; senior standing.

301. Individual Topics. For seniors and first-year graduate students who wish to study individual problems and topics not assigned in other courses. Undergraduates may not offer more than 5 hours in Botany 300 and 301 toward a bachelor's degree, nor graduate students more than 1 unit in Botany 300 and 301 toward a master's degree. II; 2 to 5 hours, or ¼ to ½ unit. Prerequisite: Botany 100 and 101, or 104; 10 hours of advanced work in botany or another biological science; senior standing.

304. General Plant Morphology. A survey of the principles of plant morphology as exemplified by the various plant groups. I; 3 or 5 hours, or ½ or 1 unit. Prerequisite: Botany 100 and 101, or 104, or 105, or Division of General Studies 131 and 132; senior standing, or consent of instructor. Mr. Buchholz.

306. Biology for Teachers. Same as Zoology 306. A teacher-training and review course for those engaged in or preparing for teaching general biology in high school. II; 2 hours, or ¼ or ½ unit. Prerequisite: Botany 100 and 101; Zoology 101; junior standing. Mr. Fuller, Mr. Matteson.

307. Fruit Diseases. Same as Horticulture 307 and Plant Pathology 307. Symptomatology; laboratory and field studies of representative diseases; control measures. I; 3 hours, or ½ unit. Prerequisite: Botany 317 or 372. Offered in 1949-1950 and in alternate years. Mr. Anderson.

308. Vegetable Diseases. Same as Horticulture 308 and Plant Pathology 308. Symptomatology; laboratory and field studies of representative diseases; control measures. II; 3 hours, or ½ unit. Prerequisite: Botany 317 or 372. Offered in 1948-1949 and in alternate years. Mr. Linn.

317. Plant Pathology. Same as Horticulture 317 and Plant Pathology 317. Causes, diagnosis, and treatment of plant diseases. I; 3 hours, or ½ unit. Prerequisite: Junior standing; one year of plant science including either Botany 100 and 101, or 104, or 105. Mr. Stevens.

320. Cytology. Study of cell structure and cell division with special emphasis on plants. II; 4 hours, or 1 unit. Prerequisite: One year of botany including Botany 340; senior standing. Mr. Buchholz.

322. Genetics. A basic treatment of the facts and fundamental principles of genetics, with special emphasis on plants. I; 4 hours, or 1 unit. Prerequisite: One year of botany; senior standing. Mr. Laughnan.

325. Paleobotany. Same as Geology 325. The structure, phylogeny, and geological distribution of representative fossil plants. Two or three field trips. II; 3 or 5 hours, or ½ or 1 unit. Prerequisite: Botany 100 and 101, or 104, or Division of General Studies 131 and 132 and Geology 101, or consent of instructor. Offered in 1948-1949 and in alternate years. Mr. Stewart.

333. Plant Physiology. Physiology of plant growth, responses, and reproduction. I; 3 or 5 hours, or ½ or 1 unit. Prerequisite: Botany 130; junior standing. Offered in 1948-1949 and in alternate years. Mr. Fuller.

335. Plant Physiology: Metabolic Transformations. II; 3 or 5 hours, or ½ or 1 unit. Prerequisite: One year of botany, including Botany 130; one year of chemistry; junior standing. Mr. Nance.

340. Histological Technic. Survey of technics used in the preparation of plant tissues for microscopical examination. II; 3 hours, or ½ unit. Prerequisite: One year of botany or ten hours of zoology; junior standing. Mr. Tippo.

344. Spermatophytes. Morphology of seed plants. II; 3 or 5 hours, or ½ or 1 unit. Prerequisite: One year of botany including Botany 304; senior standing. Offered in 1949-1950 and in alternate years. Mr. Buchholz.

345. Plant Anatomy. Study of the internal structure of vascular plants with special emphasis on function and evolutionary history. I; 3 hours, or ½ unit. Prerequisite: One year of botany; junior standing. Mr. Tippo.

360. Advanced Systematic Botany. Phylogenetic study of flowering plants; relationship of the principal orders and families; problems of nomenclature; identification of specimens. I; 3 or 5 hours, or ½ or 1 unit. Prerequisite: Botany 160; junior standing. Offered in 1949-1950 and in alternate years. Mr. Jones.

366. Field Botany. Identification and classification of native and naturalized flowering plants of eastern North America. S; 3 or 5 hours, or ½ or 1 unit. Prerequisite: Junior standing; one course in botany; consent of instructor. Mr. Jones.

372. General Mycology. Structure, classification, and identification of fungi, including those of economic importance. II; 4 hours, or 1 unit. Prerequisite: One year of botany, bacteriology, entomology, or zoology; senior standing, or consent of instructor. Mr. Shanor.

379. Research Methods in Plant Pathology. Same as Horticulture 379 and Plant Pathology 379. Lectures and laboratory on the techniques for identifi-

cation of plant diseases and their causal agents; for evaluation of plant protectants; for the study of the physiology of parasitism, and methods for planning research projects, evaluating data, and preparation of manuscripts for publication. I; 3 hours, or ½ unit. Prerequisite: Botany 317; senior standing. Offered in 1949-1950 and in alternate years. Mr. Gerdemann, Mr. Gottlieb, Mr. Thornberry.

381. Plant Ecology. I; 3 hours, or ½ unit. Prerequisite: One year of botany; junior standing. Mr. Vestal.

385. Plant Geography of North America. I; 3 or 5 hours, or ½ or 1 unit. Prerequisite: One year of botany; junior standing. Offered in 1949-1950 and in alternate years. Mr. Vestal.

386. Plant Geography of Continents Other Than North America. I; 3 or 5 hours, or ½ or 1 unit. Prerequisite: One year of botany; junior standing. Offered in 1948-1949 and in alternate years. Mr. Vestal.

388. Ecology: Plant Communities. II; 3 or 5 hours, or ½ or 1 unit. Prerequisite: One year of botany including Botany 280 or 281; junior standing. Offered in 1949-1950 and in alternate years. Mr. Vestal.

BUSINESS ORGANIZATION AND OPERATION

(Including Accountancy, Business Law, Management, and Marketing)

The Department of Business Organization and Operation, sometimes styled "applied economics," offers graduate work leading to advanced degrees in three different fields — accountancy, management, and marketing. In a fourth field within the department, business law, no advanced degree is awarded but there are two courses which carry graduate credit and may be taken to satisfy requirements for a minor in other fields.

The degree of Master of Science is offered in the fields of accountancy, management, and marketing. The Doctor of Philosophy degree is offered only in accountancy. In satisfying the requirements for any of the degrees offered in the department, a student is advised to take courses in economics to the extent it seems desirable to make up deficiencies in his undergraduate curriculum.

Candidates for any of the degrees granted within the department may select minors from any of the other fields within the department.

Graduate Teaching Faculty

Professors: H. T. Scovill (Head of Department), A. G. Anderson, H. H. Baily, D. Borth, L. A. Bryan, P. D. Converse, A. Grimshaw, H. W. Huegy, A. C. Littleton, L. Morey, C. F. Schlatter, E. P. Strong.

Associate Professors: F. H. Beach, R. I. Dickey, C. J. Gaa, F. M. Jones, M. J. Mandeville, C. A. Moyer, H. L. Newcomer, E. L. Theiss, H. G. Wales.

ACCOUNTANCY

Candidates for the Master of Science or Doctor of Philosophy degree in Accountancy must have had the equivalent of twenty hours of undergraduate work in accountancy and at least one course each in principles of economics and finance. Graduate students in other departments who choose accountancy as a minor must present similar courses, with fifteen instead of twenty hours in accountancy as a minimum.

Courses for Graduates

424. Specialized Systems. Accounting procedures used by industrial and mercantile enterprises in handling their special problems; study of uniform accounting systems. I, II; 1 unit. Mr. Baily.

427. Accounting Techniques. Analytical survey of application of accounting techniques to various special fields; accounting principles and procedures applied to governmental organizations, contractors, banks, insurance companies, manufacturing concerns, and other business activities. Credit not allowed for this course in addition to credit for Accountancy 366, 324, and 341. I, II; 1 unit. Mr. Moyer, Mr. Theiss.

441. Governmental Accounting. Advanced study in accounting and other fiscal procedures of the federal government; state, county, and municipal governments; institutions. I; 1 unit. Mr. Morey.

466. Cost Accounting. A critical examination of cost accounting methods as to truth and expediency. I, II; 1 unit. Mr. Schlatter.

471. Accounting Reports. Form, contents, certificates, comments, consolidated statements, auditor's rights and responsibilities, published corporation reports. I, II; 1 unit. Mr. Scovill.

472. Auditing Standards and Techniques. A critical analysis of the techniques used in auditing; interrelation of audit standards, procedures, principles, and techniques; internal control as related to audit techniques; trends and developments in the accounting profession. I; 1 unit. Mr. Moyer.

473. System Design and Installation. Problems and procedures in connection with designing and installing accounting systems. I, II; 1 unit. Mr. Baily.

474. Income Tax Development. A theoretical and historical approach to the study of the development of federal income taxation, together with some research on tax cases and critical appraisal of the current law and proposals for its revision. I, II; 1 unit. Mr. Gaa.

481. Concepts and Principles. The fundamental structure of accounting theory is developed through the study of concepts characteristic of accounting and an examination of the literature dealing with the concise formulation of accounting principles. I; 1 unit. Mr. Littleton.

483. Income Determination. A study of the pros and cons of various unsettled issues involved in the calculation and disclosure of enterprise periodic income. II; 1 unit. Mr. Littleton.

487. Surplus and Dividends. The theories underlying the treatment of balance sheet items deserve close consideration in accounting, because the balance sheet reflects the effect of conflicting ideas about the bases for setting up restrictions on the freedom of directors to dispose of corporation assets as dividends. II; 1 unit. Mr. Littleton.

489. History of Accounting Theory. An examination of the more important aspects of accounting theory under the impact of changing conditions over four centuries, with major emphasis on the later developments. I; 1 unit. Mr. Littleton.

491. Thesis (A.M.). Private consultations regarding theses, and seminar discussions of progress made. I, II; 1 unit. Mr. Littleton and others.

492. Thesis (Ph.D.). Private consultations regarding theses, and seminar discussions of progress made. I, II; 1 unit. Mr. Littleton, Mr. Morey, Mr. Scovill.

Courses for Graduates and Advanced Undergraduates

308. Advanced Accounting. Reserves, sinking funds, actuarial methods, investments, partnerships, statements for special purposes, receiverships, consolidated balance sheets, foreign exchange. I, II; 3 hours or ½ unit. Prerequisite: Accountancy 106 and 108; junior standing; average of 3.0 or better in preceding courses in accountancy. Mr. Breen, Mr. Newcomer.

324. Accounting Systems. A discussion of the systems used by contractors, department stores, finance companies, building and loan associations, banks, insurance companies, brokers, water companies. I, II; 2 hours, or ½ unit. Prerequisite: Accountancy 106 and 108; junior standing. Mr. Baily, Mr. Carrithers.

341. Governmental Accounting. Accounts of institutions, municipalities, and of state and federal governments; organization; procedure, budget, accounts and records, reports, audits. I, II; 2 hours, or ½ unit. Prerequisite: Accountancy 108; junior standing. Mr. Yankee.

362. Business Budgets and Accounting Control. Procedures used in the preparation of business budgets and the principles underlying these procedures. A complete budget is prepared by the student for a typical manufacturing company. I, II; 3 hours, or ½ unit. Prerequisite: Accountancy 108 (Accountancy 106 for students majoring in industrial administration); junior standing. Mr. Theiss.

366. Advanced Cost Accounting. Advanced accounting for production management. Principles and methods of accounting for managerial control of costs of production through the use of standards. I, II; 2 hours, or ½ unit. Prerequisite: Minimum of 9 hours of accountancy including Accountancy 106; junior standing. Mr. Dickey, Mr. Schlatter, Mr. Theiss.

371. Auditing. Ethics of the accounting profession; auditing standards and procedures; programs of audit of various accounts; construction and indexing of working papers; report to clients. I, II; 3 hours, or ½ unit. Prerequisite: Accountancy 308; junior standing. Mr. Breen, Mr. Mautz.

372. Auditing Problems and Cases. Application of auditing principles in verification of financial statements; preparation of reports; case studies appli-

cable to specific industries; current trends. I; 3 hours, or ½ unit. Prerequisite: Accountancy 371. Mr. Mautz, Mr. Moyer.

374. Income Tax Procedure. Practical training in the more common and important provisions and calculations of the federal income tax, together with some historical and theoretical background. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Credit or registration in Accountancy 308; senior standing. Mr. Gaa.

377. Advanced Problems. Consolidated statements, foreign subsidiaries, insurance, estates, theory, general statements. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Credit or registration in Accountancy 371; senior standing. Mr. Moyer, Mr. Newcomer, Mr. Scovill, Mr. Wakefield.

378. C.P.A. Problems. Selected problems from C.P.A. examinations; analysis and revision of statements, partnerships, corporations, quasi-reorganizations, mergers, and others; theory, auditing, ethics. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Accountancy 377. Mr. Carrithers, Mr. Moyer, Mr. Newcomer.

BUSINESS LAW

The two courses listed below may be taken for graduate credit by students whose advisors approve their selection as satisfying part or all of the requirements for a minor for the master's degree.

Courses for Graduates and Advanced Undergraduates

301. The Law of Security Transactions and Banking. Significant phases of law in the fields of pledges, chattel mortgages, conditional sales, suretyship, insurance, real property, banks and banking, and bankruptcy. Under real property, real estate mortgages, landlord and tenant and mechanics liens are considered as well as the general principles of real property. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Credit or registration in Business Law 202; senior standing. Mr. Dillavou.

302. Wills, Estates, and Trusts. A study of the basic legal and management principles and practices involved in the planning and administration of wills, estates, and trusts. I; 3 hours, or ½ to 1 unit. Prerequisite: Business Law 201 and 202.

MANAGEMENT

Work may be done in the field of management for a major or a minor for the Master of Science degree, and for a minor for the Doctor of Philosophy degree. To do major work in this field, a student must have completed at least twenty hours of undergraduate work in marketing, management, economics, business law, or accountancy, at least six hours of which must have been in the field of management. To do minor work in this field a student must have had at least twelve hours of work in the subjects named above, of which three must have been in management.

Courses for Graduates

401. Scientific Management. A study of the development of modern industrial management and the principles and practices employed at the present time. I, II; 1 unit. Mr. Mandeville.

402. Scientific Management. A study of the development of modern industrial management and the principles and practices employed at the present time. I, II; 1 unit. Mr. Mandeville.

416. Problems in Business Policy. Advanced problems in policy evaluation, determination, execution, administration, and control. Policy objectives in integration of product, marketing, manufacturing, finance, and organization. I; 1 unit.

449. Problems of Personnel Management. Same as Labor and Industrial Relations 449. A seminar and laboratory course dealing with the problems and practices encountered by personnel managers subsequent to the employment process. Students will do field work in businesses and industries in the area on such topics as incentives, rating, employee services, and community relations. I, II; 1 unit.

491. Thesis. I, II; 1 unit. Mr. Mandeville.

Courses for Graduates and Advanced Undergraduates

301. Management in Manufacturing. Internal problems of production and efficient control in factories. I, II; 3 hours, or ½ unit. Prerequisite: Management 101. Mr. Brohm, Mr. Grimshaw, Mr. Mandeville.

311. Administrative Policies and Organization. Development of administrative organizations and the determination of policies for the integration of major activities of a business enterprise. I, II; 3 hours, or ½ unit. Prerequisite: Management 101; Marketing 101; senior standing. Mr. Mandeville.

312. Problems of Administration and Organization. Same as Labor and Industrial Relations 312. Problems of the individual and groups brought about by modern industrial organizations and techniques. Motivations for work and cooperation between executives and different economic and social groups. I, II; 3 hours, or ½ unit. Prerequisite: Management 101, or equivalent. Mr. Dubin.

362. Job Wage and Contract Administration. An advanced, specialized treatment of the techniques, methods, and problems current in the wage and salary field. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Psychology 145 or 290; Economics 240 or 248.

MARKETING

Work may be done in the field of marketing for a major or a minor for the Master of Science degree, and for a minor for the Doctor of Philosophy degree. To do major work in this field, a student must have completed at least twenty hours of undergraduate work in marketing, management, economics, business law, or accountancy, at least six hours of which must have been in the field of marketing. To do minor work in this field a student must have had at least twelve hours of work in the subjects named above, of which three must have been in marketing.

Courses for Graduates

401. Marketing Principles and Problems. Functional, commodity, and institutional methods of studying marketing with particular reference to the analysis and classifications of functions, commodities, and institutions. I, II; 1 unit. Mr. Converse.

402. Marketing Methods and Problems. Selected problems in the operation and management of market institutions. I, II; 1 unit. Mr. Converse.

407. Prices and Price Policies. An examination of the role of prices in our economy, and of price making under conditions of competition, monopoly, or monopolistic competition, with special emphasis on non-price competition; an examination of business pricing policies and of their acquisitive and social implications and significance. I, II; 1 unit. Mr. Huegy.

421. Analysis of Consumer Markets. A study of consumers and their demands. I, II; 1 unit. Mr. Converse.

471. Sales Campaigns. Problems in managing the sales force. I, II; 1 unit. Mr. Beach.

472. Sales Campaigns. Problems in managing the sales force. I, II; 1 unit. Mr. Beach.

481. Advanced Advertising Principles. Same as Journalism 481. Emphasis is placed on determination and understanding of the principles as related to the science, philosophy, and art of advertising. I; 1 unit. Mr. Sandage.

482. Research Methods in Advertising. Same as Journalism 482. A critical study of research methods and their applications to the solution of advertising problems. II; 1 unit. Mr. Sandage.

491. Thesis. Thesis or independent study in the field of marketing. I, II; 1 unit. Mr. Converse and others.

Courses for Graduates and Advanced Undergraduates

305. Contemporary Problems in Marketing Management. The problems which marketing managers are currently facing and an analysis of the policy decisions they must make to operate effectively. I, II; 3 hours, or ½ unit. Prerequisite: Marketing 101; senior standing. Mr. Huegy.

315. Retail Buying. Principles and procedures in buying for resale. Organization for buying, analysis of customer demand, model stock plans, sources of supply, resident buying, cooperative and central buying, foreign buying, selection of merchandise, and trade relations. I, II; 2 hours, or ½ unit. Prerequisite: Marketing 211.

321. Market Research and Policies. The basic techniques used in business research and specific research projects, and how their findings are used in the formulation of marketing policies. I, II; 3 hours, or ½ unit. Prerequisite: Marketing 101. Mr. Luck.

323. Problems in Market Research. Selected problems in the field of commercial research. I, II; 3 hours, or ½ unit. Prerequisite: Marketing 321. Mr. Converse.

331. Grain Grading and Marketing. Same as Agronomy 331 and Agricultural Economics 331. Factors affecting the quality of grain crops; standards employed in their classification and grading in the commercial market; laboratory practice in grain grading; a trip to a commercial grain grading laboratory; economic problems and market operations in grain marketing. I; 3 hours, or ½ unit. Prerequisite: Agricultural Economics 130 and Agronomy 121, or consent of instructor. Mr. Ashby.

332. Marketing Livestock. Same as Agricultural Economics 332. Livestock market practice as applied in current marketing operations. II; 2 hours, or ½ unit. Prerequisite: Agricultural Economics 130, Marketing 101, or consent of instructor. Mr. Ashby.

333. Marketing Horticultural Products. Same as Agricultural Economics 333 and Horticulture 333. Producing and consuming areas; transportation; refrigeration; agencies, functions, and channels of distribution; cooperatives; marketing costs and factors affecting prices; standardization, grading, and inspection; marketing news service; perishable agricultural commodity act and other regulations; attempts to control surpluses; canning and other processing; foreign trade; consumer preference and expansion of domestic markets. I; 3 hours, or ½ unit. Prerequisite: Agricultural Economics 130, Marketing 101, or 12 hours of horticulture. Mr. Kelly.

334. Marketing Dairy Products. Same as Agricultural Economics 334 and Dairy Production 334. The dairy industry in our national economy; factors affecting per capita consumption; price plans and policies; expanding markets; trade associations and labor unions; looking ahead in the milk business. Inspection trip; estimated expense, $5. II; 3 hours, or ½ unit. Prerequisite: Agricultural Economics 130, or Marketing 101, or 12 hours of dairy production or dairy technology. Mr. Bartlett.

345. Credits and Collections. Retail and mercantile credit and collection principles and practices. I, II; 3 hours, or ½ unit. Prerequisite: Marketing 101; junior standing. Mr. Huegy and others.

349. Trade Associations and Commercial Organizations. Principles of trade association and Chamber of Commerce organization and management. II; 2 hours, or ½ unit. Prerequisite: Marketing 101; Business Law 201; senior standing. Mr. Howard.

372. Advanced Salesmanship. An application of sales techniques to actual selling situations. Students make sales presentations, and critical appraisals are given. I, II; 3 hours, or ½ unit. Prerequisite: Marketing 271. Mr. Beach, Mr. Wales.

373. Sales Management. Modern sales organization; selling problems of manufacturers, wholesalers, and retailers; management of salesmen. I, II; 2 hours, or ½ unit. Prerequisite: Marketing 271. Mr. Beach and others.

381. Introduction to Advertising. A survey of the economics, psychology, and philosophy of advertising; preparation of advertisements; selection of media and organizational structure. I, II; 3 hours, or ½ unit. Prerequisite: Marketing 101. Mr. Luck, Mr. Wales, and others.

382. Advertising Copy and Layout. Same as Journalism 382. Theory and practice of advertising copy writing and layout for newspaper, magazine, and direct mail. Advertising planning for the local advertiser. Use of consumer and market surveys, copy-testing methods, and advertising readership studies. I, II; 4 hours, or ½ unit. Prerequisite: Journalism 281, or Marketing 381. Mr. Seil.

383. Advertising Media. Same as Journalism 383. Analysis of the various advertising media in terms of markets served and factors to consider in the selection of media. I, II; 2 hours, or ½ unit. Prerequisite: Journalism 281, or Marketing 381.

384. Advertising Campaigns. Same as Journalism 384. Planning and execution of an advertising campaign; market and consumer research; development and allocation of advertising budget; organization and functions of advertising agency; choice of advertising appeals; selection of media; preparation of advertisements — copy and layout. I, II; 3 hours, or ½ unit. Prerequisite: Marketing 381, or Journalism 281. Mr. Wedding.

385. Advertising Promotion and Sales. Same as Journalism 385. Sales problems, advertising promotion, advertising research, market research. I, II; 3 hours, or ½ unit. Prerequisite: Journalism 382. Mr. McClure.

386. Radio Advertising. Same as Journalism 386. Economics, standards, and ethics as applied to radio commercials; sponsorship, rates, and advertising techniques, including merchandising, marketing, servicing, and sales; preparation and presentation of radio advertising copy, measurements, and listener surveys. I, II; 2 hours, or ½ unit. Prerequisite: Journalism 281, or Marketing 381. Mr. Sandage.

387. Advertising Policies and Problems. Same as Journalism 387. Analysis of actual advertising situations and study of how such situations were or might have been met. Consideration given to management and technical problems at both the national and retail levels. I, II; 3 hours, or ½ to 1 unit. Graduate students will not receive credit for both Marketing 384 and 387. Prerequisite: Journalism 281, or Marketing 381.

CERAMIC ENGINEERING

The Department of Ceramic Engineering offers graduate work leading to the degrees of Master of Science in Ceramics, Master of Science in Ceramic Engineering, Doctor of Philosophy in Ceramics, and Doctor of Philosophy in Engineering.

The prerequisite for a major in graduate work in ceramics or ceramic engineering is proficiency in the undergraduate courses required for the degree of Bachelor of Science in the branch of the subject in which registration is desired, or substantial equivalents.

Candidates for the degree of Doctor of Philosophy in Ceramics must have had the equivalent of at least twenty-five semester hours of satisfactory courses in general, analytical, physical, and organic chemistry; also calculus, one year of college physics, one semester of optical mineralogy, and at least eighteen semester hours or their equivalent in acceptable ceramic courses.

Fellowships

The following Graduate College fellowships are offered by the Department of Ceramic Engineering: American Refractories Institute Fellowship; A. P. Green Fire Brick Company Fellowship; Illinois Clay Products Company Fellowship; Edward Orton, Jr., Fellowship; Owens-Illinois Fellowship; Titanium Alloy Manufacturing Company Fellowship.

Graduate Teaching Faculty

Professors: A. I. Andrews (Head of Department), R. L. Cook, R. K. Hursh, F. V. Tooley.

Assistant Professors: A. W. Allen, E. D. Lynch.

Courses for Graduates

401. Ceramic Chemistry. Silica, silicates, fusions, and phase relations. I; 1 unit. Prerequisite: Courses in chemistry and physics. Mr. Andrews.

402. Ceramics. Chemical and physical phenomena. II; 1 to 2 units. Prerequisite: Courses in physics and chemistry. Mr. Andrews.

403. Drying. Includes laboratory if taken for two units. I or II; 1 to 2 units. Prerequisite: Graduate standing in ceramic engineering; Ceramic Engineering 203, or equivalent. Mr. Hursh.

404. Firing. Includes laboratory if taken for two units. I or II; 1 to 2 units. Prerequisite: Graduate standing in ceramic engineering; Ceramic Engineering 204, or equivalent. Mr. Hursh.

405. Glass Technology. This course, designed for ceramic engineering graduates, is required for students majoring in glass technology, and may be elected by students majoring in some other branch of ceramic engineering. The course is concerned with the study of the properties of glass of importance in manufacturing and end use; emphasis is placed equally on research, control, development, and production aspects of the subject. I; 1 unit. Prerequisite: Graduate standing in ceramic engineering; Ceramic Engineering 214 and 217, or 410. Mr. Tooley.

406. Glass Technology. This course, designed for ceramic engineering graduates, is required for students majoring in glass technology, and may be elected by students majoring in some other branch of ceramic engineering. The course, a continuation of Ceramic Engineering 405, completes the formal study of glass by taking up lesser known properties of importance in manufacture and end use. The course includes comprehensive literature surveys on selected topics and seminar type reports on classical researches in glass technology. Emphasis tends to the research point of view. II; 1 unit. Prerequisite: Ceramic Engineering 405. Mr. Tooley.

407. Porcelain Enamels. Advanced study in the composition, properties, and processing of porcelain enamels. I or II; 1 to 2 units. Prerequisite: Graduate standing in ceramic engineering; Ceramic Engineering 216 and 256, or equivalent. Mr. Andrews.

408. Refractories. Includes laboratory if taken for two units. I or II; 1 to 2 units. Prerequisite: Graduate standing in ceramic engineering; Ceramic Engineering 212, or equivalent. Mr. Allen, Mr. Hursh.

409. Special Ceramic Bodies and Glazes. Includes laboratory if taken for two units. I or II; 1 to 2 units. Prerequisite: Graduate standing in ceramic engineering; Ceramic Engineering 211, or equivalent. Mr. Cook.

410. Glass Technology. This course is designed for graduates of physics, chemistry, and engineering (including chemical engineering), and foreign students, to be taken as a minor subject in graduate work, or to prepare the student for major graduate work in glass technology. Emphasis is placed on the research phases of the various topics to prepare the student more for research and development rather than production work in the field. I; 1 unit. Mr. Tooley.

411. Glass Technology. Continuation of Ceramic Engineering 410. II; 1 unit. Prerequisite: Ceramic Engineering 410. Mr. Tooley.

491. Thesis. Research in any of the branches of ceramics. I; 1 to 4 units. Prerequisite: Graduate standing in ceramic engineering. Mr. Andrews, Mr. Allen, Mr. Cook, Mr. Hursh, Mr. Lynch, Mr. Tooley.

492. Thesis. Research in any of the branches of ceramics. II; 1 to 4 units. Prerequisites: Graduate standing in ceramic engineering. Mr. Andrews, Mr. Allen, Mr. Cook, Mr. Hursh, Mr. Lynch, Mr. Tooley.

495. Materials and Special Problems. Conference and laboratory. I or II; 1 to 2 units. Prerequisite: Graduate standing in ceramic engineering. Mr. Andrews, Mr. Allen, Mr. Cook, Mr. Hursh, Mr. Lynch, Mr. Tooley.

CHEMISTRY

(Including Chemical Engineering)

The degrees offered in chemistry and chemical engineering are Master of Arts or Master of Science in Chemistry, Master of Science in Chemical Engineering, and Doctor of Philosophy in Chemistry or Chemical Engineering.

Students who have fulfilled the undergraduate course requirements as specified in the Graduate College Catalog may apply for entrance to the Graduate College in chemistry if they have a grade point average of 3.75 in their undergraduate subjects exclusive of hygiene, military, and physical education courses.

Students who have obtained graduate credit in some other university may apply for admission provided, (1) their undergraduate records meet the above requirements, and (2) their grade point averages in graduate work are at least 4.00. If their undergraduate averages are less than 3.75, they must have received grade point averages of at least 4.25 in a year of graduate work elsewhere before being granted permission to enter the Graduate College in chemistry at the University of Illinois.

All students who receive permits to enter the Graduate College in chemistry or chemical engineering, regardless of whether they have had training beyond the bachelor's degree, must take registration examinations. These are offered in

the week prior to the opening of the first semester for those entering in the summer or in the fall, and in the week prior to the opening of the second semester for those entering in February. Those who intend to major in any field of chemistry must take four examinations covering the normal undergraduate instruction in inorganic, analytical, organic, and physical chemistry; those who intend to specialize in chemical engineering must take two of the examinations in chemistry, one of which must be physical chemistry and the other of the student's own selection; and, in addition, two in chemical engineering covering the usual undergraduate instruction in that subject. The results of these registration examinations are not permanently recorded but serve merely to assist in the registration of students in the proper graduate courses. Students who demonstrate through these examinations that they are deficient will be required to register in one or more specific courses before taking more advanced work in a particular field. Most of these courses allow graduate residence credit. Students who have received permits to enter the Graduate College in chemistry or chemical engineering should contact the Department immediately to learn the dates when these registration examinations will be given and to obtain any other detailed information desired.

Students who intend to take graduate work for an advanced degree in chemistry or chemical engineering should include in their undergraduate preparation at least the equivalent of one full year of physics, one year of French, one year of German, and mathematics through differential and integral calculus. Any student without the necessary physics or mathematics may enter the Graduate College but will be required to spend part of his time in residence to remove the deficiency. In order to be admitted as a candidate for an advanced degree in chemistry student must have had one year of college French or German (preferably German). Where the applicant has done two or three years of work in French or German in secondary school, the requirement will be considered to be met, provided at least one semester of the language more advanced than his secondary school work has been done in college. Four years of French or German completed in a secondary school will be accepted in lieu of any college work in the subject. An applicant who has a knowledge of French or German, but who lacks formal credentials, may be examined to determine his language status. Such an applicant should correspond with the Director of Admissions and Records with reference to this examination.

In meeting the language requirements for the degree of Doctor of Philosophy in Chemistry, a student may substitute Russian for French on the direct recommendation of the Department of Chemistry (and without formal petition), provided such recommendation is approved by the Dean of the Graduate College.

Candidates for an advanced degree in chemistry must have had the equivalent of twenty-five semester hours in chemistry, properly distributed.

Candidates for the Master of Arts or Master of Science degree with a major in chemistry must include among their courses Chemistry 240 and 241, or equivalent.

Candidates for the Doctor of Philosophy degree in any branch of chemistry must include among their courses Chemistry 240, 241, 342, and 343, or equivalent.

Before taking chemistry courses for graduate credit, graduate students whose major subject is in some department other than chemistry must have had the equivalent of fifteen semester hours in chemistry, including satisfactory work in general chemistry, qualitative and quantitative analysis, and elementary organic chemistry. Such students are advised to make selections from the following

Board Where Pressure and Temperature Are Controlled
gh-Pressure Experiments in Chemical Engineering

courses: Chemistry 240, 241, 315, 316, 327, 329, 336, 337, 342, 343, and 350. Courses of a more special nature will not, as a rule, be accepted for graduate work unless preceded by one of the above courses.

Those who intend to take a first minor in chemistry or any branch of chemistry toward the Doctor of Philosophy degree must include among their courses Chemistry 240 and 241, or must have had the equivalent.

Candidates for the degree of Master of Science in the Teaching of Chemistry must earn four units of chemistry, two units in education, and two units in electives. Requirements are chemistry, 4 units; Education 400, Philosophy of Education, or Education 302, History of American Education, 1 unit; and Education 409, Advanced Educational Psychology, 1 unit. The courses in chemistry and the electives must be selected with the approval of the advisor. The electives may be in chemistry, in education, or, in exceptional cases, in other fields. The advisor for candidates for this degree is Professor J. C. Bailar, Jr., 107 Chemistry Annex.

For work in physical sciences, see page 198.

Fellowships

The Graduate College offers fellowships to worthy students including those who intend to specialize in chemistry or chemical engineering. Applications should be sent to the Dean of the Graduate College. In addition, the Chemistry Department has industrial or institutional fellowships and research assistantships for chemistry and chemical engineering students which vary in number from year to year. These appointments are awarded upon application, more often to those students who have already been at the University of Illinois for two semesters and who have demonstrated their ability in the Graduate College. The department also has several post-doctoral research assistantships available. Applications for research assistantships should be sent directly to the Chemistry Department.

Teaching assistantships in chemistry and chemical engineering are numerous. These are open to all students who are entering for graduate study. Applications for teaching appointments should be made directly to the Chemistry Department.

Graduate Teaching Faculty

Professors: R. Adams (Head of Department), L. F. Audrieth, J. C. Bailar, A. M. Buswell, H. E. Carter, G. L. Clark, E. W. Comings, D. T. Englis, R. C. Fuson, H. F. Johnstone, H. A. Laitinen, C. S. Marvel, T. E. Phipps, W. H. Rodebush, W. C. Rose, G. F. Smith, H. R. Snyder, F. T. Wall.

Associate Professors: G. T. Moeller.

Assistant Professors: E. R. Alexander, Virginia Bartow, H. G. Drickamer, R. B. Duffield, R. L. Frank, N. J. Leonard, D. R. Martin, B. R. Ray, C. S. Vestling.

Courses for Graduates

402. Inorganic Chemistry. The less familiar elements and their relationship in the periodic system. Lectures, reports, and assigned readings. II; ¾ unit.

404. Inorganic Chemistry. Advanced laboratory. Inorganic preparations and qualitative analysis involving the less familiar elements. II; ¼ to ¾ unit. Prerequisite: Credit or registration in Chemistry 402.

405. Inorganic Chemistry. Seminar. Required of all graduate students whose major is inorganic chemistry. I, II; ¼ unit. Mr. Audrieth.

406. Special Topics in Inorganic Chemistry. Discussions and reports. I, II; ¾ unit. Mr. Martin.

421. Optical Methods of Chemical Analysis. I; ¾ unit. Prerequisite: General physics and chemistry equivalent to a major for a bachelor's degree. Mr. Englis.

422. Electrical Methods of Chemical Analysis. Lectures and laboratory. Polarography, potentiometric, amperometric, conductometric titrations, dielectric methods, etc. II; ¾ unit.

423. Qualitative Microanalysis. Lectures and laboratory. Micro-techniques, spot tests, and organic reagents. I; ¾ unit. Prerequisite: Chemistry 110 and 124, or equivalent. Mr. Laitinen.

424. Quantitative Analysis. Advanced principles, calculations, experimental methods, and applications. Required of all graduate students whose major or minor is analytical chemistry. II; ½ unit.

425. Analytical Chemistry. Seminar. Special topics in analytical chemistry. Required of all graduate students whose major or minor is analytical chemistry. I, II; ¼ to 1 unit. Prerequisite: Students must be taking major or first minor for the degree of Doctor of Philosophy in analytical division. Mr. Clark.

426. Applied X-rays. Lectures. I; ½ unit. Prerequisite: Training in physics and physical chemistry. Mr. Clark.

427. Applied X-rays. Lectures. II; ½ unit. Prerequisite: Training in physics and physical chemistry.

428. Applied X-rays. Laboratory. Optional laboratory work to accompany lectures in Chemistry 426 and 427. Training in operation of all types of X-ray apparatus with special emphasis on diffraction; experimental chemical identification and crystal structure analyses from powder and single crystal patterns. I; ½ unit. Prerequisite: Chemistry 426 and 427; training in physics, mathematics, and physical chemistry. Mr. Clark.

429. Applied X-rays. Laboratory. Optional laboratory work to accompany lectures in Chemistry 426 and 427. Training in operation of all types of X-ray apparatus with special emphasis on diffraction; experimental chemical identification and crystal structure analyses from powder and single crystal patterns. II; ½ unit. Prerequisite: Chemistry 426 and 427; training in physics, mathematics, and physical chemistry.

430. Organic Chemistry. Survey of organic chemistry designed for first-year graduate students. I, II; 1 unit. Prerequisite: One year (10 hours) of organic chemistry. Mr. Fuson.

432. Organic Chemistry. Advanced survey of organic chemistry (to follow Chemistry 430). II; 1 unit. Prerequisite: Chemistry 430, or equivalent. Mr. Snyder.

433. Organic Chemistry. Optical isomerism, *cis-trans* isomerism, tautomerism, chemistry of the carbohydrates, etc. I; ¾ unit. Prerequisite: Chemistry 430 and 432, or consent of instructor. Mr. Leonard.

434. Advanced Organic Synthesis. I, II; ½ to 1 unit. Mr. Miller.

435. Organic Chemistry. Seminar. Current literature in organic chemistry. I, II; ¼ unit. Prerequisite: Consent of instructor. In most cases, students must be doing research in organic chemistry and be registered for the degree of Doctor of Philosophy. Mr. Adams.

436. Organic Chemistry. Quantitative organic analysis and newer methods in organic laboratory procedure. A laboratory course designed to acquaint students with newer research techniques. I, II; ½ to 1 unit. Mr. Frank.

440. Physical Chemistry. Survey of physical chemistry for graduate students. I, II; ¾ to 1 unit. Prerequisite: Chemistry 240 and 342, or equivalent. Mr. Wall.

441. Chemical Thermodynamics. Fundamental laws of thermodynamics and calculation of thermodynamic quantities. I; 1 unit. Prerequisite: Elementary physical chemistry. Mr. Wall.

442. Chemical Thermodynamics. Fundamental laws of thermodynamics and calculation of thermodynamic quantities. II; 1 unit. Prerequisite: Elementary physical chemistry.

443. Physical Chemistry. Molecular structure. II; ¾ unit. Prerequisite: Chemistry 342.

444. Physical Chemistry. Kinetic theory and statistical mechanics. I or II; ¾ unit. Prerequisite: Chemistry 441 and 442. Mr. Phipps.

445. Physical Chemistry. Seminar. I, II; ½ to ¾ unit. Prerequisite: Chemistry 240, 342, 441, and 442. Mr. Rodebush.

447. The Spectra and Structure of Polyatomic Molecules. Lectures. The deduction of chemical information from molecular spectra: bond lengths, force constants, dissociation energies, molecular symmetry, functional groups. I; ¾ unit. Prerequisite: Chemistry 342.

448. The Spectra and Structure of Polyatomic Molecules. Lecture and laboratory. Designed for those students wishing to acquire a working knowledge of molecular spectra. The laboratory will consist largely of experimental work chosen by the student according to his interests. II; ¾ unit. Prerequisite: Chemistry 447.

450. Biochemistry. Chemistry of intermediary metabolism. Lectures and readings. II; ¾ unit. Prerequisite: Chemistry 350, or equivalent.

452. Biochemistry. Difficult biochemical preparation; analytical methods. Chiefly laboratory. I, II; ½ to 1 unit. Prerequisite: Chemistry 350, or equivalent. Mr. Rose.

455. Biochemistry. Seminar. Current literature. Required of all graduate students whose major is biochemistry. I, II; ¾ unit. Prerequisite: Chemistry 350, or equivalent. Mr. Rose.

485. Chemistry of Water Treatment. Seminar. Special problems and new de-

velopments in sanitary chemistry. I, II; ¼ to 1¼ units. Prerequisite: Graduate standing in science or engineering. Mr. Buswell.

490. Research. Candidates for the Master of Arts or Master of Science degree who elect research are required to present a thesis. A thesis is always required of students working toward the degree of Doctor of Philosophy. Not all candidates for thesis work necessarily will be accepted. Students whose major is in departments other than chemistry must receive permission from the Head of the Chemistry Department to register in this course. I, II; 1 to 4 units. Work may be taken in the following fields, subject to the approval of one of the qualified staff members:

Analytical Chemistry. Mr. Clark, Mr. Englis, Mr. Laitinen, Mr. Smith.

Applied X-rays and Electron Microscopy. Mr. Clark.

Biochemistry. Mr. Carter, Mr. Rose, Mr. Vestling.

Ceramic Chemistry. Mr. Andrews.

Food Chemistry; Phytochemistry. Mr. Englis.

Inorganic Chemistry. Mr. Audrieth, Mr. Bailar, Mr. Laitinen, Mr. Martin, Mr. Moeller.

Organic Chemistry. Mr. Adams, Mr. Alexander, Mr. Frank, Mr. Fuson, Mr. Leonard, Mr. Marvel, Mr. Snyder.

Physical Chemistry. Mr. Phipps, Mr. Ray, Mr. Rodebush, Mr. Wall.

Polarography and Related Topics. Mr. Laitinen.

Water Chemistry; Zymochemistry. Mr. Buswell.

492. Chemical Literature and Reference Work. I; ¼ unit. Miss Bartow.

Courses for Graduates and Advanced Undergraduates

315. Inorganic Chemistry. Nuclear and extra-nuclear atomic structures and their relation to the properties of the elements and of their compounds; types of bonding; survey of the periodic relationships, preparation, and applications of the elements and their compounds. I, II; 3 hours, or ¾ unit. Prerequisite: Fifteen hours of credit in chemistry courses exclusive of courses numbered below 110. Mr. Martin.

316. Inorganic Chemistry. Preparation of typical inorganic compounds illustrating special and more advanced techniques. I, II; 2 hours, or ½ unit. Prerequisite: Credit or registration in Chemistry 315. Mr. Martin.

325. Analytical Chemistry. A survey course for advanced undergraduate and graduate students requiring further training and review in analytical chemistry. II; 3 hours, or ¾ unit. Prerequisite: Advanced standing in chemistry.

326. Chemical Analysis and Treatment of Water. Chemical and instrumental methods for analysis of water and determination of quality. Chemical principles and processes in water purification and conditioning. Relationship of chemistry of water to municipal and industrial use. I; 3 hours, or ¾ unit. Prerequisite: Chemistry 124. Mr. Englis.

327. Special and Instrumental Methods of Analysis. Gas analysis; electrometric titration, optical methods, and other advanced analyses. I, II; 3 hours, or ¾ unit. Prerequisite: Chemistry 124, 234, 240, and 241. Mr. Smith.

328. Chemical Microscopy and Crystallography. The theory and practice of the use of the optical microscope in chemical identification and analysis, and in the characterization and classification of crystals; principles of crystallization, crystal growth, polymorphism. I; 3 hours, or ¾ unit. Prerequisite: Chemistry 124 and 240; consent of instructor. Mr. Clark.

329. Food Analysis. Quantitative organic analysis of food products; alcohols, carbohydrates, fats and oils, cereals, nitrogenous bodies, preservatives, and colors. II; 5 hours, or 1¼ units. Prerequisite: Chemistry 122 or 124, and 133 or 234.

336. Organic Chemistry. Second course. Lectures and recitations. I, II; 3 hours, or ¾ unit. Prerequisite: Chemistry 124 and 234. Mr. Marvel.

337. Organic Chemistry. Laboratory experiments in organic chemistry. I, II; 2 hours, or ½ unit. Prerequisite: Chemistry 234 and 336. Mr. Frank.

338. Systematic Identification of Organic Compounds. I, II; 3 hours, or ¾ unit. Prerequisite: Chemistry 336 and 337, or equivalent. Mr. Fuson, Mr. Snyder.

342. Elementary Physical Chemistry. Lectures. I, II; 3 hours, or ¾ unit. Prerequisite: Chemistry 240. Mr. Phipps.

343. Elementary Physical Chemistry. Laboratory to accompany Chemistry 342. I, II; 1 hour, or ¼ unit. Prerequisite: Chemistry 240 and 241; credit or registration in Chemistry 342. Mr. Gutowsky.

344. Principles of Chemical Thermodynamics. Thermodynamics and free energy calculations. I, II; 2 hours, or ¾ unit. Prerequisite: Chemistry 240 and 342, or consent of instructor. Mr. Rodebush.

345. Colloid and Surface Chemistry. Physical chemistry of colloid systems; properties of surfaces and inter-faces; applications. I; 3 hours, or ¾ unit. Prerequisite: Chemistry 336 and 342, or consent of instructor. Mr. Ray.

346. Atomic Structure Valence. Advanced physical chemistry. I or II; 2 hours, or ½ unit. Prerequisite. Chemistry 240 and 342.

350. Biochemistry. Chemistry of carbohydrates, lipids, and proteins; the alimentary processes, blood, tissues, and metabolism; quantitative analysis of gastric contents, blood, and urine. Clinical aspects for prospective students of medicine. Lectures, conferences, laboratory, and readings. I, II; 5 hours, or 1¼ units. Prerequisite: Chemistry 122 or 124, and 133 or 234. Mr. Carter, Mr. Henderson, Mr. Rose, Mr. Vestling, and others.

351. Techniques of Blood Analysis and Their Applications. II; 3 hours, or ¾ unit. Prerequisite: Chemistry 350.

352. Biochemistry of Vitamins and Hormones. II; 3 hours, or ¾ unit. Prerequisite: Chemistry 350.

395. History of Science with Particular Reference to Chemistry. I; 2 hours, or ¼ unit. Prerequisite: Junior standing with 20 hours of laboratory science. Miss Bartow.

397. Radiochemistry. Properties of radioactive nuclei, nature of radioactivity, nuclear reactions, detection equipment, and tracer technique. Lectures. I, II; 2 hours, or ½ unit. Prerequisite: Chemistry 240 and 241. Mr. Duffield.

398. Radiochemistry. Laboratory to accompany Chemistry 397. I, II; 1 hour, or ¼ unit. Prerequisite: Chemistry 240 and 241; credit or registration in Chemistry 397; consent of instructor. Mr. Duffield.

CHEMICAL ENGINEERING

The Department of Chemistry offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy in Chemical Engineering. Candidates for these degrees should have had undergraduate training comparable to that offered at the University of Illinois, including mathematics through calculus, and year courses in physics, mechanics, and electrical engineering. Students who enter without the usual engineering courses prescribed in the undergraduate chemical engineering curriculum will be required to make up their deficiencies to the extent prescribed by their advisor.

Candidates for an advanced degree in chemical engineering must have had the equivalent of twenty-five hours in chemistry, including organic and physical chemistry.

A reading knowledge of German and French or Russian is recommended for all graduate students in chemical engineering. In meeting the language requirements for the degree of Doctor of Philosophy in Chemical Engineering, a student may substitute Russian for French on the direct recommendation of the Department of Chemistry (and without formal petition), provided that such recommendation is approved by the Dean of the Graduate College.

Candidates for the Master of Science degree in Chemical Engineering must include Chemical Engineering 387 and 388 among their courses.

A student who chooses chemical engineering as a minor must take at least two units of work in this subject for the Master of Science degree, or four units for the Doctor of Philosophy degree.

Courses for Graduates

463. Evaporation, Drying, Humidification, and Dehumidification. Lectures. I; ¾ unit. Prerequisite: Chemical Engineering 373. Offered in 1949-1950 and in alternate years.

464. Absorption and Extraction. Lectures. I; ¾ unit. Prerequisite: Chemical Engineering 373. Offered in 1948-1949 and in alternate years. Mr. Johnstone.

465. Chemical Engineering. Seminar. Required of all graduate students whose major is chemical engineering. I, II; ¼ unit. Prerequisite: Chemical Engineering 373. Mr. Johnstone.

466. Filtration and Separations. Properties of particulate matter: aerosols, suspensions, slurries, and packed beds; methods of comminution and separation. Lectures and problems. II; ¾ unit. Prerequisite: Chemical Engineering 373. Offered in 1948-1949 and in alternate years.

467. Distillation. Application of principles of distillation to binary and multicomponent mixtures including a discussion of azeotropic and extractive distillation. II; ¾ unit. Prerequisite: Chemical Engineering 373. Offered in 1949-1950 and in alternate years.

468. Advanced Plant Design. Problems in equipment design and plant layout. Lectures and conferences. II; ¾ unit. Prerequisite: Chemical Engineering 373, 387, and 388. Offered in 1949-1950 and in alternate years.

469. Industrial Reaction Kinetics and Catalysis. The prediction of physical properties and absolute reaction rates from theory. The application of these to the design of industrial reactors. II; 1 unit. Prerequisite: Graduate standing in chemical engineering; consent of instructor. Offered in 1948-1949 and in alternate years.

490. Research. Candidates for the master's degree who elect research are required to write a thesis. A thesis is always required for the degree of Doctor of Philosophy. Not all candidates for thesis work necessarily will be accepted. Any student whose major is in another department must receive permission from the Head of the Department to register in this course. I, II; ¼ to 4 units. Mr. Comings, Mr. Drickamer, Mr. Johnstone, Mr. Straub, Mr. Swann.

Courses for Graduates and Advanced Undergraduates

370. Chemical Engineering Thermodynamics. The fundamental concepts and laws of thermodynamics; primarily for students in chemical engineering. I, II; 3 hours, or ½ unit. Prerequisite: Chemical Engineering 261; Chemistry 240. Mr. Drickamer and others.

371. Principles of Chemical Engineering. Scientific principles in unit operations of chemical engineering. Lectures, problems, and quizzes. II; 4 hours, or 1 unit. Prerequisite: Chemical Engineering 370, or consent of instructor.

372. Unit Operations Laboratory. First course. To accompany Chemical Engineering 371. I, II; 2 hours or ¼ unit. Prerequisite: Credit or registration in Chemical Engineering 371.

373. Principles of Chemical Engineering. Scientific principles in unit operations of chemical engineering. Lectures, problems, and quizzes. I; 4 hours, or 1 unit. Prerequisite: Chemical Engineering 371; Chemistry 240. Mr. Drickamer and others.

374. Unit Operations Laboratory. Second course. To accompany Chemical Engineering 373. I, II; 2 hours or ¼ unit. Prerequisite: Credit or registration in Chemical Engineering 373. Mr. Baron, Mr. Campbell, Mr. Westwater, and others.

377. Chemical Engineering Technology. Study of industrial chemical processes and principles. I; 3 hours, or ½ unit. Prerequisite: Chemistry 240. Mr. Campbell.

379. Chemical Engineering Projects Laboratory. Development of an individual project. I, II; 2 hours, or ½ unit. Prerequisite: Senior standing in chemistry or chemical engineering. Mr. Johnstone.

380. Chemical Engineering Calculations. Numerical and graphical methods for problems in equilibria and kinetics. Lectures and recitations. II; 3 hours, or ¾ unit. Prerequisite: Chemistry 344; Chemical Engineering 371.

381. Chemical Engineering Plant Design. Comprehensive problems. II; 3 hours, or ½ unit. Prerequisite: Chemical Engineering 373.

382. High Pressure Reactions. Lectures, recitations, and problems. II; 2 hours, or ½ unit. Prerequisite: Chemistry 234 and 344.

383. Applied Electrochemistry. Use of electric current through solutions for carrying out reactions. Lectures. I; 2 hours, or ½ unit. Prerequisite: Chemistry 234, 336, and 342. Mr. Swann.

384. Power Plant and Boiler Water Problems. I; 2 hours, or ½ unit. Prerequisite: Senior standing in chemical engineering. Mr. Straub.

387. Flow of Fluids. Advanced course. Lectures, recitations, and problems. I; 2 hours, or ¾ unit. Prerequisite: Chemical Engineering 371, or equivalent with consent of instructor. Mr. Comings.

388. Heat Transmission. Advanced course. Lectures, recitations, and problems. I; 2 hours, or ¾ unit. Prerequisite: Chemical Engineering 371, or equivalent with consent of instructor. Mr. Comings.

CIVIL ENGINEERING

(Including Sanitary Engineering)

The graduate student in civil engineering generally follows one of three fields, transportation and municipal engineering, hydraulic engineering, or structural engineering. The work leads to the degree of Master of Science in Civil Engineering and to the degree of Doctor of Philosophy in Engineering. The prerequisite for graduate work in civil engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in the branch of the subject in which registration is desired.

The work in sanitary engineering leads to the degree of Master of Science in Sanitary Engineering and to the degree of Doctor of Philosophy in Engineering. The prerequisite for admission to the first year of graduate study is a degree of Bachelor of Science in Sanitary Engineering, or the satisfactory completion of the sanitary option in a course in civil engineering, including basic courses in bacteriology, quantitative chemical analysis, and organic chemistry, or their equivalent in the fields of chemistry and biology.

Graduate Teaching Faculty

Professors: W. C. Huntington (Head of Department), H. E. Babbitt, J. S. Crandell, J. J. Doland, N. M. Newmark, W. A. Oliver, R. B. Peck, T. C. Shedd, J. Vawter, C. C. Wiley, W. M. Wilson.

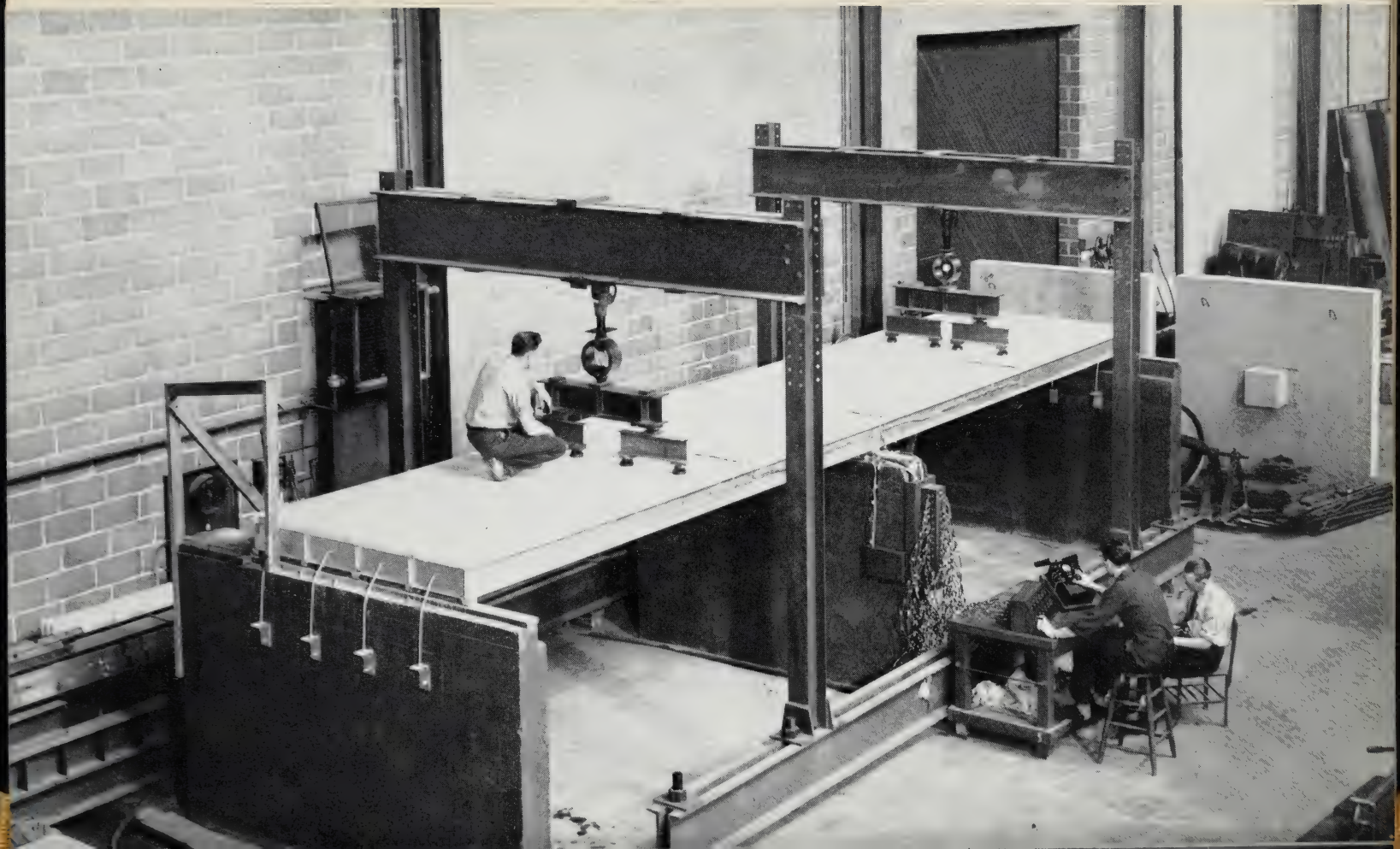
Associate Professors: E. E. Bauer, J. G. Clark.

Assistant Professor: W. W. Hay.

Lecturers: A. E. Cummings, K. Terzaghi.

Courses for Graduates

20. Highway Engineering. Highway construction, street layouts, regional plans, and pavements for cities. I; 1 unit. Prerequisite: Civil Engineering 220. Mr. Crandell.



422. Municipal Engineering. City finances and budgets, work of the city engineer, city manager, zoning, playgrounds and parks, street cleaning, smoke prevention, fire prevention. II; 1 unit. Prerequisite: Civil Engineering 220. Mr. Crandell.

423. Highway Traffic, Transport, and Safety. Traffic growth, characteristics, surveys, regulations, and signaling; private and commercial transportation by automobile, bus, and truck; transport organization and regulation; accident surveys, analysis, and prevention. I, II; 1 unit. Prerequisite: Civil Engineering 223, or equivalent. Mr. Wiley.

424. Airport Design. Selection of site, soil investigation, layout, drainage, runway design and construction, hangars and other structures, and other civil engineering features of airport design and construction. I, II; 1 unit. Prerequisite: Graduate standing in civil engineering. Mr. Reickert.

425. Railway Location and Operation. Railway location; track capacity; tonnage ratings; train scheduling. I; 1 unit. Prerequisite: Civil Engineering 203, 226, or equivalent experience, or consent of instructor. Mr. Hay.

426. Railway Location and Operation. Continuation of Civil Engineering 425. Additional problems in railway location and maintenance; design of yards, turnouts, and passenger stations; economics of maintenance; railway labor. II; 1 unit. Prerequisite: Civil Engineering 425, or equivalent, or consent of instructor. Mr. Hay.

440. Water Supply. Design, pumping machinery, administration, and operation. I; 1 unit. Prerequisite: Bachelor of Science degree in sanitary engineering, or equivalent. Mr. Babbitt.

443. Sewerage. Sewer design, construction, maintenance, operation, and financing. II; 1 unit. Prerequisite: Bachelor of Science degree in sanitary engineering, or equivalent. Mr. Babbitt.

444. Sewage Disposal, Wastes Disposal, and General Sanitation. Principles and design of sewage treatment and waste disposal works. II; 1 unit. Prerequisite: Bachelor of Science degree in sanitary engineering, or equivalent. Mr. Babbitt.

446. Water Purification and General Sanitation. Design of water purification works and principles of sanitation. I; 1 unit. Prerequisite: Bachelor of Science degree in sanitary engineering, or equivalent. Mr. Babbitt.

448. Sanitary Engineering. Laboratory. Tests of water supply; sewerage; water purification and sewage treatment equipment and processes. I, II; 1 to 2 units. Mr. Babbitt.

450. Hydrology and Flood Control. Magnitude and frequency of flood flow of streams, minimum flow of streams, and regulation of flow by storage reservoirs; intense rainfall and the development of intensity curves for use in rational run-off formula; unit-graph method of computing flood run-off; flood control and prevention by channel improvement, levees, and reservoirs. I, II; 1 unit. Prerequisite: Civil Engineering 250 and 351, or equivalent. Mr. Doland.

452. Water Resources Planning and Development. Purposes and technics of planning water resources developments; methods of evaluating the engineer-

ing and economic aspects of water conservation projects developed through the examination of actual proposals. II; 1 unit. Prerequisite: Bachelor of Science degree in civil engineering or consent of instructor. Mr. Doland.

455. Water Power Engineering. Preliminary investigations, selection of site, storage requirements, structures, machinery, etc. I, II; 1 unit. Prerequisite: Civil Engineering 255, or equivalent. Mr. Doland.

461. Structural Theory and Design. General theory of continuity; moment distribution; the column analogy; rigid frame bridges and buildings; fixed and continuous arches; classification of structures from viewpoint of design. I, II; 1 to 2 units. Prerequisite: Bachelor of Science degree in civil engineering with a basic course in indeterminate structures. Mr. Shedd, Mr. Vawter.

462. Structural Theory and Design. Statically indeterminate trusses; continuous trusses; steel arches; secondary stresses; suspension bridges; long-span roofs; skeleton steel buildings. I, II; 1 to 2 units. Prerequisite: Bachelor of Science degree in civil engineering with a fundamental course in indeterminate structures. Mr. Shedd, Mr. Vawter.

464. Reinforced Concrete Design. Theories of action of beams, slabs, and columns of rein concrete; codes and specifications and their influence on design; effect of continuity. I, II; 1 unit. Prerequisite: Bachelor of Science degree in engineering with undergraduate courses in structures. Mr. Shedd.

465. Steel Design. Design of steel members; codes and specifications for buildings; riveted and welded connections; evolution of bridge specifications; loads and working stresses; economic proportions. I, II; 1 unit. Prerequisite: Bachelor of Science degree in engineering with undergraduate courses in structures. Mr. Shedd.

469. Wood Structures. Theory and practice in the design of modern wood structures; the effect of the plant origin and physical structure of wood on its mechanical strength; fasteners and their significance in design and the development of design formulae. I, II; 1 unit. Mr. Oliver.

470. Earth Pressures and Retaining Walls. A study of earth pressures considering the significant properties of soils; methods of computing earth pressures and the limitations in their dependability; stability computations; and the design and construction of retaining walls and abutments. I; 1 unit. Prerequisite: Bachelor of Science degree in civil engineering. Mr. Huntington.

471. Earth and Masonry Dams. Stability of rolled-fill and hydraulic-fill dams; methods of construction; seepage losses; control of seepage forces; safety of foundations. Solid gravity, arched gravity, arch, multiple arch and slab and buttress dams; safety against sliding and overturning; unit stresses on horizontal sections and principal stresses; joints; drainage; foundations. II; 1 unit. Mr. Huntington, Mr. Peck.

473. Soil Mechanics. Physical properties of soils; identification and description of soils; permeability, compressibility, consolidation, and shearing resistance; deformation and drainage characteristics. Theories of soil mechanics; earth pressure, stability, settlement, seepage, and consolidation. I; 1 unit. Mr. Peck.

474. Soil Mechanics. Practical considerations, boring, sampling, testing; retaining walls, open cuts, slides, dams and embankments; foundations, settlements due to excavation and other causes; field observations. Limitations and alternatives to conventional procedures of design and construction. II; 1 unit. Prerequisite: Civil Engineering 473. Mr. Peck.

481. Advanced Structural Analysis: Approximate Methods. Methods of successive approximations, and numerical procedures, for the solution of complex problems, with applications to bridges, buildings, and aircraft structures. Method of successive relaxation of constraints, energy methods, difference equations, numerical integration procedures, method of collocation, method of least squares, and Galerkin's method. I or II; 1 to 2 units. Mr. Newmark.

482. Advanced Structural Analysis: Buckling, Vibrations, and Impact. Elastic and inelastic instability of bars, plates, and plates with stiffeners; vibrations of structures including earthquake effects; action of simple structural elements and of more complex structures subjected to dynamic loads, with applications to bridges, buildings, and aircraft structures. I or II; 1 to 2 units. Mr. Newmark.

485. Analytical Study of Tests of Structural Members. Planning tests, limitations of experimental methods, interpretation of results in terms of design practice. II; 1 unit. Mr. Wilson.

486. Advanced Analysis and Design of Aircraft Structures. Analysis and design of frames and individual members of aircraft structures. I, II; 1 to 2 units. Mr. Clark.

487. Design of Advanced Aircraft Structures. Structural design of the components of aircraft and the design of their attachments. II; 1 to 2 units. Prerequisite: Civil Engineering 486. Mr. Clark.

491. Thesis (M.S. and Ph.D.). I, II; ½ to 4 units.

493. Special Problems. Individual investigations or studies of any phase of civil engineering selected by the student. I, II; ½ to 2 units.

Courses for Graduates and Advanced Undergraduates

344. Water and Sewage Treatment. Principles, design, and operation of water purification and sewage treatment works. I; 5 hours, or 1 unit. Prerequisite: Credit or registration in Bacteriology 104 and Civil Engineering 240 or 241.

345. Public Health Engineering. Principles of sanitation, waste collections, and disposal; sanitary regulations, biostatistics. II; 3 hours, or ½ unit. Prerequisite: Credit or registration in Bacteriology 104 and Chemistry 122.

351. Drainage and Flood Control. Land drainage, river improvement, flood control. II; 3 hours, or ½ unit. Prerequisite: Civil Engineering 250.

361. Statically Indeterminate Structures. Elastic theory and its applications to statically indeterminate structures. I, II; 3 hours, or ½ unit. Prerequisite: Civil Engineering 262; credit or registration in Civil Engineering 264.

362. Statically Indeterminate Structures. I, II; 3 hours, or ½ unit. Prerequisite: Civil Engineering 361, or 262 and consent of instructor.

386. Advanced Aircraft Structures. Structural theory and design of aircraft; analysis of unsymmetrical sections, multiple cell structures with thin skin in bending and torsion, and stiffened flat and curved sheets; combined stresses; deflection of beams and trusses. I, II; 3 hours, or ½ unit. Prerequisite: Civil Engineering 262 and 263.

387. Advanced Aircraft Structures. Analysis of semi-tension field beams, beam-columns, closed frames, curved beams, and indeterminate trusses; column analogy and moment distribution. I, II; 3 hours, or ½ unit. Prerequisite: Civil Engineering 386.

THE CLASSICS

The Department of Classics offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy.

The degree of Master of Arts may be taken in Latin, in Greek, in the Classics, or in the Teaching of Latin. For the degree of Master of Arts in the Classics, the major may be either Latin or Greek, with the other language offered as a minor.

The Degree of Doctor of Philosophy is given in Classical Philology. Major work may be taken in either Latin or Greek, but whichever language is taken as a major, the other one must be taken as a first minor.

All graduate students should take the course in Bibliography and Criticism, Latin 495 and 496, during their first year of graduate study. The graduate courses in the various Greek and Latin authors are arranged in cycles so that a properly qualified student will normally have an opportunity to take any particular course during the three years of residence required for the doctor's degree.

Graduate Teaching Faculty

Professors: H. Larsen (Acting Head of Department), B. E. Perry, A. Turyn.

Associate Professor: R. P. Oliver.

Instructor: F. D. Lazenby.

GREEK

Preparation for first-year graduate work in Greek should include at least three years of college Greek, or equivalent, and two years of college Latin. A reading knowledge of German and French is important for candidates in this subject. The study of history and philosophy is especially recommended.

Courses for Graduates

411. Theocritus. Theocritus and the Alexandrian Age. I; 1 unit. Prerequisite: Three years of college Greek. Offered in 1948-1949 and every third year thereafter. Mr. Perry.

412. Lucian and His Age. II; 1 unit. Prerequisite: Three years of college Greek. Offered in 1948-1949 and every third year thereafter. Mr. Perry.

413. Greek Lyric Poetry. Reading of a wide selection of Greek lyrics of the classical period, with a study of representative genres and poets, including,

among others, Sappho, Alcæus, Pindar, and Bacchylides. I; 1 unit. Offered in 1949-1950 and every third year thereafter. Mr. Turyn.

414. Greek Drama: Tragedy. II; 1 unit. Prerequisite: Adequate knowledge of Greek. Offered in 1949-1950 and every third year thereafter. Mr. Turyn.

415. Homer. I; 1 unit. Prerequisite: Adequate knowledge of Greek. Offered in 1950-1951 and every third year thereafter. Mr. Turyn.

416. Thucydides. II; 1 unit. Prerequisite: Three years of college Greek or consent of instructor. Offered in 1950-1951 and every third year thereafter. Mr. Perry.

421. Aristotle. Reading and analysis of the *Politics;* its place in Greek thought. I; 1 unit. Prerequisite: Reading knowledge of Greek or graduate major in either political science or philosophy. Offered in 1948-1949 and every third year thereafter. Mr. Turyn.

422. Plato. II; 1 unit. Prerequisite: Adequate knowledge of Greek. Offered in 1948-1949 and every third year thereafter. Mr. Turyn.

424. Greek Drama: Comedy. II; 1 unit. Prerequisite: Adequate knowledge of Greek. Offered in 1949-1950 and every third year thereafter. Mr. Perry.

426. Homer (continued). II; 1 unit. Prerequisite: Adequate knowledge of Greek. Offered in 1950-1951 and every third year thereafter. Mr. Perry.

491. Research in Special Topics. Same as Latin 491. Guidance in writing theses for advanced degrees. I; 1 unit. Mr. Oliver, Mr. Perry, Mr. Turyn.

492. Research in Special Topics. Same as Latin 492. Guidance in writing theses for advanced degrees. II; 1 unit. Mr. Oliver, Mr. Perry, Mr. Turyn.

495. Bibliography and Criticism. Same as Latin 495. Introduction to the methods and techniques of scholarship. I; ½ unit. Prerequisite: Three years of college Latin, or equivalent. Mr. Oliver.

496. Bibliography and Criticism. Same as Latin 496. II; ½ unit. Prerequisite: Three years of college Latin, or equivalent. Mr. Oliver.

Courses for Graduates and Advanced Undergraduates

301. Herodotus and the Lyric Poets. I; 3 hours, or ½ unit. Prerequisite: Greek 202, or equivalent. Offered in 1948-1949 and in alternate years. Mr. Turyn.

302. Thucydides and Plato. II; 3 hours, or ½ unit. Prerequisite: Greek 301, or 303, or equivalent. Offered in 1948-1949 and in alternate years. Mr. Turyn.

303. Greek Drama. I; 3 hours, or ½ unit. Prerequisite: Greek 202, or equivalent. Offered in 1949-1950 and in alternate years. Mr. Turyn.

304. Oratory and Aristotle. II; 3 hours, or ½ unit. Prerequisite: Greek 301, or 303, or equivalent. Offered in 1949-1950 and in alternate years. Mr. Turyn.

318. Classical Archaeology. A survey of the art, public and private antiquities, and monuments of the ancient world. I; 2 hours, or ½ unit. Prerequisite: Junior standing. Mr. Lazenby.

LATIN

Preparation for first-year graduate work in Latin should include at least two years of preparatory Latin and three years of college Latin. A reading knowledge of French and German is important. Some acquaintance with Greek is highly desirable, and the study of history and philosophy is especially recommended.

Candidates for the degree of Master of Arts in the Teaching of Latin must earn four units in Latin, two units in education, and two units in electives. At least two of the four required units in Latin must be in courses numbered above 400; the other two units may be chosen in whole or in part from the following list: Latin 301, 302, 305, and 306. The required work in education is one unit in either Education 400, Philosophy of Education, or Education 302, History of American Education; and one unit in Education 409, Advanced Educational Psychology. The electives may be in Latin, in Greek, in education, or, in exceptional cases, in other fields. The courses in Latin and the electives must be selected with the approval of the advisor, Professor B. F. Perry, 126 Lincoln Hall.

Courses for Graduates

411. Latin Epigraphy. A study of inscriptions as documents illustrating the evolution of the Latin language, and as records of the customs, beliefs, and ideals of the common people of Rome and the provinces. I; 1 unit. Prerequisite: Three years of college Latin, or equivalent. Offered in 1948-1949 and every third year thereafter. Mr. Oliver.

412. Latin Elegy. II; 1 unit. Prerequisite: Three years of college Latin, or equivalent. Offered in 1948-1949 and every third year thereafter. Mr. Oliver.

413. Caesar. I; 1 unit. Prerequisite: Adequate knowledge of Latin. Offered in 1949-1950 and every third year thereafter. Mr. Turyn.

414. Lucan. II; 1 unit. Prerequisite: Adequate knowledge of Latin. Offered in 1949-1950 and every third year thereafter. Mr. Oliver.

415. Lucretius. A study of the text, the meaning, and the sources of the *De Rerum Natura.* I; 1 unit. Prerequisite: Three years of college Latin, or equivalent. Offered in 1950-1951 and every third year thereafter. Mr. Perry.

416. Vergil. II; 1 unit. Prerequisite: Adequate knowledge of Latin. Offered in 1950-1951 and every third year thereafter. Mr. Turyn.

421. Horace. I; 1 unit. Prerequisite: Adequate knowledge of Latin. Offered in 1948-1949 and every third year thereafter. Mr. Turyn.

422. Terence. II; 1 unit. Prerequisite: Adequate knowledge of Latin. Offered in 1948-1949 and every third year thereafter. Mr. Turyn.

423. Latin Romance. I; 1 unit. Prerequisite: Three years of college Latin, or equivalent. Offered in 1949-1950 and every third year thereafter. Mr. Perry.

424. Cicero's Letters. II; 1 unit. Prerequisite: Adequate knowledge of Latin. Offered in 1949-1950 and every third year thereafter. Mr. Turyn.

425. The Philosophy of Cicero. A study of the political, ethical, and religious thought expressed in the *De republica, De officiis,* and other philosophic

works. I; 1 unit. Prerequisite: Adequate knowledge of Latin. Offered in 1950-1951 and every third year thereafter. Mr. Oliver.

426. Tacitus. The *Annales*. II; 1 unit. Prerequisite: Three years of college Latin, or the equivalent. Offered in 1950-1951 and every third year thereafter. Mr. Oliver.

431. Roman Oratory. S; 1 unit. Prerequisite: Adequate knowledge of Latin. Mr. Turyn.

491. Research in Special Topics. Same as Greek 491. Guidance in writing theses for advanced degrees. I; 1 unit. Mr. Oliver, Mr. Perry, Mr. Turyn.

492. Research in Special Topics. Same as Greek 492. Guidance in writing theses for advanced degrees. II; 1 unit. Mr. Oliver, Mr. Perry, Mr. Turyn.

495. Bibliography and Criticism. Same as Greek 495. Introduction to the methods and techniques of scholarship. I; ½ unit. Prerequisite: Three years of college Latin, or equivalent. Mr. Oliver.

496. Bibliography and Criticism. Same as Greek 496. II; ½ unit. Prerequisite: Three years of college Latin, or equivalent. Mr. Oliver.

Courses for Graduates and Advanced Undergraduates

301. Livy, Tibullus, and Propertius. I; 3 hours, or ½ unit. Prerequisite: Twelve hours of Latin acceptable for a major. Mr. Oliver.

302. Ovid (*Elegy*) and Seneca (*Epistles*). II; 3 hours, or ½ unit. Prerequisite: Twelve hours of Latin acceptable for a major. Mr. Oliver.

305. Tacitus (*Annales*) and Juvenal. I; 3 hours, or ½ unit. Prerequisite: Twelve hours of Latin acceptable for a major. Offered in 1948-1949 and in alternate years. Mr. Lazenby.

306. Martial, Suetonius, and Apuleius. II; 3 hours, or ½ unit. Prerequisite: Twelve hours of Latin acceptable for a major. Offered in 1948-1949 and in alternate years. Mr. Lazenby.

311. Advanced Latin Composition. Practice in the writing of Latin prose. Required of those receiving recommendations of the department as teachers. I; 2 hours, or ½ unit. Prerequisite: Twelve hours of Latin acceptable for a major. Mr. Turyn.

312. Advanced Latin Composition. Practice in the writing of Latin prose. II; 2 hours, or ½ unit. Prerequisite: Latin 311. Mr. Turyn.

COMMERCE

Candidates for the degree of Master of Science in Commercial Teaching must earn credit as specified below.

(1) *Economics.* A sufficient number of hours in approved advanced undergraduate and graduate courses in economics must be taken to bring the total credit hours in this subject to not less than 17 for the five years.

(2) *Business Law, Management, and Marketing.* A sufficient number of hours in approved advanced undergraduate and graduate courses in business law, man-

agement, and marketing must be taken to bring the total credit hours in this group of subjects to not less than 17 for the five years.

(3) *Accountancy.* A sufficient number of hours in approved advanced undergraduate and graduate courses in accountancy must be taken to bring the total credit hours in this subject to not less than 17 for the five years, excluding Accountancy 121.

(4) *Education.* Education 400 or 302, and 409.

(5) *Commerce.* Sufficient work must be taken in the fifth year in courses recognized for graduate credit to bring the total hours in commerce courses to not less than 60 for the five years.

(6) *Electives.* Nine hours of approved advanced undergraduate and graduate courses having general educational value, and of courses which bear directly on subjects taught in high schools.

The requirements of 1-5, above, can be satisfied with a minimum of 23 hours of credit. With the 9 hours of electives (6), this makes a total of 32 hours in the fifth year, or 162 hours for the five-year program.

The maximum *required* credit hours for electives during the third, fourth, and fifth years in Commerce fields are as follows: business law, management, and marketing, 6 hours; economics, 9 hours; accountancy, 5 hours.

The advisors for candidates for this degree are Dean W. C. Robb, 214 David Kinley Hall, and Professor C. F. Schlatter, 216 David Kinley Hall.

DAIRY PRODUCTION

The Department of Dairy Production offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy. Graduate work in the department is given in three divisions: dairy production, dairy bacteriology, and dairy chemistry, each calling for a somewhat different undergraduate preparation and graduate program. One of these fields of specialization may be elected as the major subject for the master's or doctor's degree. For either degree, a first minor must be taken in another department of the University; if a second minor is elected, it may be chosen in the department.

Dairy Production. The work in dairy production deals with the genetics, physiology, nutrition, and management of dairy cattle, and with the production of milk. In general, each graduate student in dairy production will be expected to concentrate on one or another of these fields of application and to complete a research problem for the thesis requirement in one of them. To provide material for studies in these fields, the department operates a farm of 200 acres where pasture and other roughage production investigations may be conducted. It maintains a herd of nearly 300 head of cattle representing five of the dairy breeds, a herd of approximately twenty dairy goats, and a colony of rabbits which are available for teaching and experimental purposes.

Preparation for graduate work in dairy production consists of basic training in the biological and natural sciences, especially courses in chemistry, physics, physiology, zoology, genetics, and mathematics; and elementary courses in economics and in dairy production or dairy husbandry. Depending upon the particular field of concentration in dairy production a candidate wishes to pursue, advanced undergraduate work in mathematics, as well as in at least one of the other fields mentioned above, will be found useful.

Dairy Bacteriology. For graduate studies in dairy bacteriology, basic courses as an undergraduate in the natural and biological sciences, as well as the basic work in general bacteriology, are required. A general knowledge of the dairy industry is helpful. As this field of study is dependent more and more upon chemistry, the graduate student in dairy bacteriology should expect and be prepared to elect chemistry as one of the minors for an advanced degree.

Dairy Chemistry. The work in dairy chemistry is concerned primarily with the composition of milk and other products of importance to the dairy industry. While this unit of the department pursues its own researches, it serves as an integrating group on chemical problems for the production and bacteriology divisions. A graduate student in this field should expect to take most of his work for the major in some phase of chemistry. A minor could well be taken in some other aspect of dairying: manufactures, bacteriology, or production. The undergraduate training required includes basic training in general chemistry, including qualitative and quantitative analysis, introductory work in organic chemistry and agricultural chemistry or biochemistry.

The candidate for graduate work in the Department of Dairy Production who does not have the proper basic training for his graduate specialty may enter that field, provided the deficiency is made up early in the graduate program by taking the foundation courses needed. Such courses will not contribute toward credit for the degree. Finally, under usual circumstances, the candidate should have acquired proficiency in one foreign language before starting graduate work (see language requirements for Ph.D. degree listed earlier).

Graduate Teaching Faculty

Professors: G. W. Salisbury (Head of Department), R. W. Bartlett, W. L. Gaines, W. B. Nevens, O. R. Overman, W. W. Yapp.

Assistant Professors: R. J. Keirs, W. O. Nelson, N. L. Van Demark.

Courses for Graduates

405. Economic Milk Production. II; 1 to 2 units. Mr. Yapp.

408. Physiology of Lactation. II; ½ to 2 units. Mr. Gaines.

450. Dairy Bacteriology. Assigned laboratory problems in dairy bacteriology. I, II; ½ to 2 units. Prerequisite: Dairy Production 150, 151, and 350. Mr. Nelson, Mr. Salisbury.

453. Dairy Bacteriology Seminar. Review of current literature in dairy bacteriology, and discussion of current problems. II; ½ unit. Mr. Salisbury.

480. Dairy Chemistry. Assigned problems. I, II; ½ to 2 units. Mr. Overman.

490. Dairy Production Seminar. Current literature relating to various phases of milk production. I, II; ½ unit. Mr. Gaines, Mr. Nevens, Mr. Overman, Mr. Salisbury, Mr. Yapp.

493. Research. Work may be taken in the following subjects: Dairy bacteriology, dairy chemistry, dairy cattle breeding, dairy cattle feeding, milk production. Graduate students writing a thesis should so indicate when registering. I;

1 to 4 units. Mr. Gaines, Mr. Keirs, Mr. Nelson, Mr. Nevens, Mr. Overman, Mr. Salisbury, Mr. VanDemark, Mr. Yapp.

494. Research. Work may be taken in the following subjects: Dairy bacteriology, dairy chemistry, dairy cattle breeding, dairy cattle feeding, milk production. Graduate students writing a thesis should so indicate when registering. II; 1 to 4 units. Mr. Gaines, Mr. Keirs, Mr. Nelson, Mr. Nevens, Mr. Overman, Mr. Salisbury, Mr. VanDemark, Mr. Yapp.

Courses for Graduates and Advanced Undergraduates

311. Problems in Dairy Farming. Dairy farm operation, including field and building arrangement, cropping systems, herd management, sanitary milk production, and farm marketing problems. Lectures, quiz, assigned readings, and problems. I; 3 hours, or ¾ unit. Prerequisite: Dairy Production 100 and 202; junior standing. Mr. Yapp.

320. Special Problems. I, II; 5 hours, or 1 unit. Prerequisite: Senior standing; approval of head of department. Mr. Gaines, Mr. Keirs, Mr. Nelson, Mr. Nevens, Mr. Overman, Mr. Salisbury, Mr. VanDemark, Mr. Yapp.

334. Marketing Dairy Products. Same as Agricultural Economics 334 and Marketing 334. The dairy industry in our national economy; factors affecting per capita consumption; price plans and policies; expanding markets; trade associations and labor unions; looking ahead in the milk business. Inspection trip; estimated expense, $5. II; 3 hours, or ½ unit. Prerequisite: Agricultural Economics 130, or Marketing 101, or 12 hours of dairy production or dairy technology. Mr. Bartlett.

350. Advanced Dairy Bacteriology. Bacteriology of dairy products — normal and abnormal. I; 4 hours, or 1 unit. Prerequisite: Bacteriology 104 and 105; junior standing. Mr. Nelson.

380. Composition of Dairy Products. I; 3 hours, or ¾ unit. Prerequisite: Chemistry 132; junior standing. Mr. Keirs, Mr. Overman.

ECONOMICS

The Department of Economics offers graduate work leading to the degrees of Master of Arts, Master of Science, and Doctor of Philosophy. Students who wish to make economics their major subject for an advanced degree must have had at least 27 hours of undergraduate work in social science, fifteen of which must have been in economics; the work in economics must include a course in principles of economics, a course in statistics, and other courses for which the course in principles is a prerequisite. Students in other departments who wish to take a minor in economics must have had at least twelve hours in social sciences, eight hours of which must have been in economics, consisting of a course in principles of economics and other courses for which the course in principles is a prerequisite. Students who can not meet these requirements may register for graduate work but, unless specially exempted for reasons satisfactory to the advisor in charge, must remove any deficiencies during the first year of residence by taking prescribed courses without graduate credit.

A first-year student whose major is economics must take either Economics 400-401 or 402-403. If a minor is taken outside the department, two units of work will ordinarily be required. Undergraduate courses that are approved for graduate credit may be taken in lieu of graduate courses but not to exceed a total credit of two units.

A student who wishes to become a candidate for the Doctor of Philosophy degree with a major in economics must pass a preliminary examination showing: (1) a detailed knowledge of economic theory and its history; (2) a detailed knowledge of certain special fields of economics or allied fields, the number and selection of which is to be determined by the advisor in consultation with the student; and (3) a general acquaintance with the subject matter and bibliography of other branches of economics. In the work offered in some related field outside the department the student will be expected to satisfy the examiners as to his proficiency in that subject.

A student who chooses economics as a minor for the Doctor of Philosophy degree must take at least two units of work in this department.

Graduate Teaching Faculty

Professors: P. H. Brown (Acting Head of Department), H. K. Allen, V. L. Bassie, J. F. Bell, R. H. Blodgett, H. R. Bowen, Dorothy S. Brady, H. M. Gray, E. E. Hagen, D. P. Locklin, E. B. McNatt, W. H. McPherson, W. A. Neiswanger, Margaret G. Reid, D. W. Smythe, E. T. Weiler.

Associate Professors: W. E. Chalmers, J. F. Due, D. P. Flanders, R. W. Harbeson, D. L. Kemmerer, R. M. Nolen, J. B. Parrish, W. C. Robb, G. A. Steiner, P. M. Van Arsdell.

Assistant Professors: Grace Beckett, F. B. Haworth, G. Kleiner, J. L. McConnell, R. I. Mehr, D. W. Paden.

Courses for Graduates

400. General Economic Theory. A preliminary survey of business, labor, government, monetary, and other institutional aspects of economics, followed by a more extended analysis of theoretical economics and the application of this theory to some of the problems raised in the preliminary survey. Intended for students whose minor is economics and other students who have only the minimum preparation for graduate study in economics. I; 1 unit. Prerequisite: Economics 102 and 103 or 108. Mr. Flanders.

401. General Economic Theory. A preliminary survey of business, labor, government, monetary, and other institutional aspects of economics, followed by a more extended analysis of theoretical economics and the application of this theory to some of the problems raised in the preliminary survey. Intended for students whose minor is economics and other students who have only the minimum preparation for graduate study in economics. II; 1 unit. Prerequisite: Economics 102 and 103 or 108. Mr. Flanders.

402. Economic Theory. The principles of economics, with special emphasis on value and distribution, for students whose major is economics and others who have had a thorough training in economics. I; 1 unit. Prerequisite:

At least 27 hours of undergraduate work in social sciences, 15 of which must have been in economics; the work in economics must include a course in the principles of economics, a course in statistics, and other courses for which the course in principles is a prerequisite. Mr. Blodgett.

403. Economic Theory. The principles of economics, with special emphasis on value and distribution, for students whose major is economics and others who have had a thorough training in economics. II; 1 unit. Prerequisite: At least 27 hours of undergraduate work in social sciences, 15 of which must have been in economics; the work in economics must include a course in the principles of economics, a course in statistics, and other courses for which the course in principles is a prerequisite. Mr. Blodgett.

404. Economic Stabilization Policies. An examination of alternative proposals for economic stabilization through governmental fiscal and monetary operations, with particular emphasis on the interrelation between budgetary and central bank operations. I; 1 unit. Prerequisite: Economics 303; Economics 214 is recommended but not required. Mr. Hagen.

406. A History of Economic Thought. Development of economic thought from early times to the present. I; 1 unit. Mr. Bell.

407. History of Economic Thought. Development of economic thought from early times to the present. II; 1 unit. Mr. Bell.

410. Comparative Economic Systems. The economics of capitalism, socialism, communism, and fascism. I; 1 unit. Mr. Blodgett.

414. Public Finance. A critical study of the application of economic principles to public expenditures, revenues, borrowing, and administration of funds. I; 1 unit. Prerequisite: Six hours of economics. Mr. Allen.

415. Public Finance. A critical study of the application of economic principles to public expenditures, revenues, borrowing, and administration of public funds. II; 1 unit. Prerequisite: Six hours of economics. Mr. Allen.

418. Contemporary Economic Problems and Literature. This course gives the student an opportunity to read critically some of the books which are significant in contemporary economic literature but which he has not read in other courses. S; ½ unit. Mr. Brown.

420. Monetary Theory and History. A study of the development of money and monetary theory to 1914: Greece and Rome, Bank of England, classical monetary theory, early United States, national banking system, and gold standard. I; 1 unit. Mr. Nolen.

421. Monetary Theory and History. A study of the development of money and monetary theory since 1914: central banking theory and practice, World War I finance, gold standard and depreciation of currencies, public spending, and contemporary theory and practice. II; 1 unit. Mr. Nolen.

426. Theories and Policies of International Commerce. Development of the theory of international trade; commercial policies. I; 1 unit. Miss Beckett.

427. Theories and Policies of International Trade. Problems in international trade. II; 1 unit. Miss Beckett.

428. International Economics and Finance. Analysis of international monetary standards; of their effects on domestic income levels, finance, and central bank problems. I; 1 unit. Prerequisite: Preparation in economics. Mr. Kleiner.

429. International Economics and Finance. Governmental policies designed to maximize domestic welfare through international exchange of goods and services and through international investment. II; 1 unit. Mr. Kleiner.

436. Economic History of the United States. Colonization, westward movement, agriculture, transportation, industrial revolution, trust movement, slavery, labor conditions and organizations, capital growth, money and banking, commerce, and social progress. Material to 1860. I; 1 unit. Mr. Kemmerer.

437. Economic History of the United States. Colonization, westward movement, agriculture, transportation, industrial revolution, trust movement, slavery, labor conditions and organizations, capital growth, money and banking, commerce, and social progress. Material since 1860. II; 1 unit. Mr. Kemmerer.

440. Labor Economics. Same as Labor and Industrial Relations 440. A critical economic analysis of contemporary English and American wage theory, employment and unemployment, and collective bargaining, with emphasis on public policy. I; 1 unit. Prerequisite: A minimum of 6 hours in economics. Mr. McNatt.

441. Labor Economics. Same as Labor and Industrial Relations 441. A critical economic analysis of contemporary English and American wage theory, employment and unemployment, and collective bargaining, with emphasis on public policy. II; 1 unit. Prerequisite: A minimum of 6 hours of economics. Mr. McNatt.

442. Problems and Practices in Collective Bargaining. Same as Labor and Industrial Relations 442. Seminar in the methods and techniques of collective bargaining in the negotiation of the labor contract; nature and significance of labor agreements; union, management, and public interests in major contract provisions. I; 1 unit. Prerequisite: Consent of instructor. Mr. McPherson.

443. Problems and Practices of Labor Dispute Settlement. Same as Labor and Industrial Relations 443. Seminar in the techniques of labor contract administration; comparative study of grievance procedure operation; analysis of conciliation, fact-finding, and arbitration procedures, including case studies of arbitration awards. II; 1 unit. Prerequisite: Consent of instructor. Mr. McPherson.

447. Labor Union Organization and Administration (Economics). Same as Labor and Industrial Relations 447. Analysis of the structure and government of the modern American trade union movement with particular reference to the relation between organization and function. Problems relating to the function and execution of economic policies, the maintenance of unity and discipline, the adjustment of jurisdictional conflicts, and the observance of agreements will be examined and appraised. II; 1 unit. Prerequisite: Major in social sciences, or consent of instructor. Mr. Chalmers.

454. Corporation Finance. Nature of corporation finance and its relation to economics, accounting, and law; development of business corporation; concepts of capital, capitalization, and capital stock; nature of equities in corporation; financial analysis and interpretation; nature and development of financial plans; corporate securities and their adaptation to financial plan; initial and promotional financing; current capital financing; income administration; refinancing; expansion. I; 1 unit. Prerequisite: Economics 254. Mr. Van Arsdell.

455. Corporation Finance. Consolidation, concentration, and intercorporate relations; the corporate institution and the problem of monopoly and competition; corporate failure and reorganization; corporate financial management and the economy. II; 1 unit. Prerequisite: Economics 254. Mr. Van Arsdell.

456. Investments. The theory and practice of investment; the return on invested capital; the classification and use of investment securities; governmental agencies for the protection of the investor. I; 1 unit. Mr. Brown.

457. Investments. Procedures to determine the investment value of corporate securities; business conditions and security price movements; the selection of securities for a portfolio, the problems presented in determining the value of a business enterprise. II; 1 unit. Prerequisite: Economics 456, or equivalent. Mr. Brown.

460. Economics of Risk and Insurance. A study of the nature and cost of risk in our economic society and of the methods of handling it. I; 1 unit. Mr. Mehr.

461. Economics of Risk and Insurance. A study of the nature and cost of risk in our economic society and of the methods of handling it. II; 1 unit. Mr. Mehr.

470. Economic Statistics. Analysis of frequency distributions and patterns of economic behavior. The problem of statistical induction and economic data. The construction and interpretation of index numbers. I; 1 unit. Prerequisite: At least one course in the principles of economics and one in statistical methods. Mr. Neiswanger.

471. Economic Statistics. Methods of analysis, economic time series; measurement and interpretation of functions in economic data. II; 1 unit. Prerequisite: At least one course in the principles of economics and one in statistical methods. Mr. Neiswanger.

473. Economic Forecasting. Forecasting techniques; analysis of important forecasting situations in terms of strategic forces and relationships; the place of judgment in evaluating current information, selecting critical factors, and appraising the validity of analytical techniques. II; 1 unit. Prerequisite: One year of statistics. Mr. Bassie.

480. Seminar in the Relations of Government and Business. Problems in the relations of government and business. Discussions and individual research in selected problems of economic policy arising from the inter-relations of government and business. I; 1 unit. Mr. Gray.

481. Seminar in the Relations of Government and Business. Problems in the relations of government and business. Discussions and individual research in selected problems of economic policy arising from the inter-relations of government and business. II; 1 unit. Mr. Gray.

484. Economics of Transportation. A study of the principal economic problems arising in connection with the development and regulation of railroads and other modes of transport. I; 1 unit. Mr. Locklin.

485. Economics of Transportation. A study of the principal economic problems arising in connection with the development and regulation of railroads and other modes of transport. II; 1 unit. Mr. Locklin.

488. Government Regulation of Economic Activity. A critical economic appraisal of the objectives and results of government policy and practice in controlling economic activity. I, II; 1 unit. Mr. Steiner.

491. Seminar (A.M. and Ph.D.). Required of all students writing masters' and doctors' theses in economics. I; 1 to 4 units. Masters' theses, Mr. Flanders. Doctors' theses, Mr. Blodgett.

492. Seminar (A.M. and Ph.D.). Required of all students writing masters' and doctors' theses in economics. II; 1 to 4 units. Masters' theses, Mr. Flanders. Doctors' theses, Mr. Blodgett.

Courses for Graduates and Advanced Undergraduates

303. Theory of Employment and the Price Level. A brief introduction to national income concepts, neoclassical theory of forces determining the level of output; presentation and critique of quantity of money theory of price level; presentation and critique of neo-Keynesian theory of price level, output, and employment; reconciliation of these theories. II; 3 hours, or ½ to 1 unit. Prerequisite: Economics 250, or consent of instructor. Mr. Hagen.

306. History of Economic Thought. A study of the development of economics. Contributions of schools of thought and individual writers are examined as they influenced economic thought and national policy. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108; senior standing. Mr. Bell.

312. Economics of Welfare. An analysis and summary of the consequences for human welfare of economic security, political and economic freedom, consumption standards, community of enterprise, ratio of population to resources, unemployment, inequality of distribution, human costs in production, etc. Utilitarianism, Germanic theories of the state, and other systems of thought relating to welfare will be examined. II; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102 or 108. Mr. McConnell.

315. Economic Problems in Federal Taxation. An intensive study of the present Federal tax system, with particular reference to inequities and effects of the taxes upon the economy; alternative measures of reform. I; 3 hours, or ½ to 1 unit. Prerequisite: Economics 214. Mr. Due.

328. Latin American Economic Problems. Economic problems of commerce, finance, transportation, mining, agriculture, and industry in Latin America;

Latin American and international economic relationships. II; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108; junior standing. Miss Beckett.

336. American Economic History. Colonization and westward movement; growth of industry, agriculture, commerce, finance, transportation, and labor. Not open to students who took Economics 336 as freshmen. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Kemmerer.

342. Economics of Social Security. Same as Labor and Industrial Relations 342. A critical analysis of the economic issues and problems involved in our legislative efforts to reduce the economic risks of unemployment, old age dependency, and industrial injury. I; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108; junior standing. Mr. McNatt.

343. The Labor Market. Same as Labor and Industrial Relations 343. Economic analysis of the labor market, its structure, characteristics, and operations in contrast with other markets; factors making for equilibrium and disequilibrium; migration; occupational and industrial mobility; labor market research including techniques and materials. II; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102 or 108, and 240; junior standing. Mr. Parrish.

344. The Law and Labor. Same as Labor and Industrial Relations 344. An economic analysis of the problems and issues arising out of the legislative and judicial efforts to define the rights, duties, and responsibilities of labor organizations and management in the field of industrial relations. II; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108; Economics 240; junior standing. Mr. McNatt.

346. Foreign Labor Movements. Same as Labor and Industrial Relations 346. Analysis of the history, organization, economic policies, political programs, and domestic, international, and contemporary influence of the labor movements of Great Britain, Sweden, Germany, France, Latin America, and Russia. I; 3 hours, or ½ to 1 unit. Prerequisite: Economics 240; junior standing. Mr. Chalmers.

363. Advanced Life Insurance. A study of the application of life insurance to the problems of family security, business security, investments, and estate protection. II; 3 hours, or ½ to 1 unit. Prerequisite: Economics 262. Mr. Mehr.

366. Casualty Insurance. An examination of hazards, contracts, forms, rates, underwriting principles, and loss prevention activities in the following branches of insurance: workmen's compensation, automobile, public liability, burglary, robbery, theft, glass, power plant, credit, accident and health, and fidelity and surety. I; 3 hours, or ½ to 1 unit. Prerequisite: Economics 260. Mr. Mehr.

371. Applied Problems in Sampling. Design of various types of samples useful in economic and business research. Cost limitations and the design of samples. Sources of bias and sampling methods. Interpretation of the results. I; 3 hours, or ½ unit. Prerequisite: One course in mathematics; Economics 170, or a similar introductory course in statistics. Mr. Neiswanger.

372. Time Series, Indexes, and Their Analysis. Training in the analysis of time series for the purpose of isolating variables, constructing statistical normals, describing the cyclical pattern and making short run forecasts. I; 3 hours, or ¼ unit. Prerequisite: One course in mathematics; Economics 170, or a similar introductory course in statistics. Mr. Haworth.

375. Statistical Analysis of the National Income and Its Distribution. The statistical aspects of estimating the national income and its distribution and of analyzing the interrelationships in national income and related series. I; 3 hours, or ½ unit. Prerequisite: Economics 170. Mrs. Brady.

378. Consumers and the Market. Market forces affecting the quantity, quality, and price of consumer goods and consumers' ability to choose wisely, with special attention to retailing, monopolistic competition, advertising, the provision of information to consumer and important controls relating to these. II; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102, 103, or 108; junior standing. Miss Reid.

379. Consumer Economics. National and family consumption and factors affecting these, such as income, price, type of community, family size and type; uses of consumption data by various groups, for example, in market, wage, tax, social security, and various other policies. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108; Economics 170; junior standing. Miss Reid.

380. Economic Problems of the Family. Economic functions and problems of the family, important changes, household production, earning the family income, its adequacy and security, the family standard of living, spending and saving, and problems of financial management. I; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108. Miss Reid.

384. Economics of Transportation. Economic aspects of the transportation industry with special emphasis on problems of regulation and public policy. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108; junior standing. Mr. Harbeson, Mr. Locklin.

385. Economic Problems of Commercial Air Transport. Study of air transport with particular reference to questions of public policy, system of regulation, and regulatory policy. I; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108; junior standing. Mr. Locklin.

390. Economics of Communications. Economic problems associated with the various forms of radio broadcasting including FM, television, and facsimile, and the use of radio for the safety and efficiency of transportation, protective services, etc. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102, 103, or 108; junior standing. Mr. Smythe.

EDUCATION

The graduate student in Education may specialize in administration and supervision, agricultural education, curriculum, educational psychology, elementary school teaching, guidance and personnel work, history and philosophy of education,

Lady Macbeth

home economics education, industrial education, research methods, secondary school teaching, and special education.

Degree of Master of Arts or Master of Science in Education. In addition to complying with the general rules of the Graduate College (see page 17), candidates for the degree of Master of Arts or Master of Science in Education must meet the following requirements:

(1) Students must select and follow an approved curriculum and consult with a designated advisor for that curriculum in planning their programs.

(2) Education 109 and 230 or 240, or equivalent, are prerequisites for all graduate courses.

(3) Education 409 is a required course for all students.

(4) A graduate course in either the History of Education or the Philosophy of Education is required for all students.

Degree of Master of Science in the Education of the Deaf. For graduate standing in the curriculum for the degree of Master of Science in the Education of the Deaf, one of the following prerequisites is necessary: (1) a bachelor's degree in elementary or special education (other than the deaf), or (2) a bachelor's degree in education of the deaf from an accredited training center for teachers of the deaf.

Candidates for the degree must earn eight units as follows:

(1) Education, 2 units, including Education 302 or 400 and Education 409.

(2) For those students qualifying under prerequisite (1), Education 317, ½ unit; Education 319, 1 or 1½ units; Education 320, 1 or 1½ units; Speech 301, ½ unit; Speech 395, ½ unit; and Speech 385, ½ unit, are required. For those students qualifying under prerequisite (2), Education 418, 1 unit; and Education 493, 1 unit are required.

(3) A field of concentration should be selected from the following electives: Speech 375, 388, 488, 489; Psychology 412, 465; Social Welfare Administration 411, 451, 452; Education 334, 381, 425, 426, 427, 430, 438, 439, 440, 443, 460; Home Economics 201 and 202.

The elective courses must be selected with the approval of the advisor, Professor S. A. Kirk, 309 Gregory Hall.

Degree of Master of Science in the Education of Mentally Handicapped Children. For graduate standing in the curriculum for the degree of Master of Science in the Education of Mentally Handicapped Children, the following prerequisites are necessary: Courses sufficient to meet the requirements for an Illinois Teacher's Certificate and the following specialized undergraduate courses: Education 231, Education 220 (Section A), and Speech 208.

Candidates for the degree must earn eight units as follows: Required courses: Education 302 or 400, 1 unit; Education 317, ½ unit; Education 322, ½ or 1 unit; Education 323, ½ or 1 unit; Education 408, 1 unit; Education 409, 1 unit; Education 426, 1 unit.

Elective courses are to be chosen from the following list: Education 334, 411, 414, 417, 434, 495, 496; Psychology 338, 404, 406, 412, 436, 471, 493, 494; Social Welfare Administration 411, 451, 452; Speech 385, 388.

The advisor for candidates for this degree is Professor S. A. Kirk, 309 Gregory Hall.

Degree of Doctor of Philosophy. For the requirements for the degree of Doctor of Philosophy, see page 19.

Professional Degrees

Degree of Master of Education (Ed.M.). This degree is designed for teachers, supervisors, administrative officers, and others engaged in educational work demanding broad, fundamental, and practical preparation and the ability to utilize professionally the contributions of research and philosophy.

A minimum of two years of approved professional experience and the completion of the requirements for the degree of Master of Arts or Master of Science, or equivalent, is required for admission to the curriculum leading to the degree of Master of Education. In addition, the candidate must be recommended by the College of Education committee on admissions of graduate students in education as showing promise of superior professional competence. In case the first year of graduate study does not include a major in education, the candidate will be required to take additional courses in education. The student's general education will also be reviewed, and appropriate courses may be required to correct any deficiencies.

A minimum of one year of approved graduate study (eight units) is required for the degree. This year of graduate study will be planned as a whole in consultation with the student's advisor. In addition to meeting other requirements, the candidate must pass a final examination administered by a college committee of at least three members.

Degree of Doctor of Education (Ed.D.). The purpose of the Doctor of Education degree is to continue the type of preparation indicated for the Master of Education degree and, in addition, to develop in the candidate further ability for scholarly study of professional problems. The requirements for the degree of Doctor of Education include: (1) graduate residence equivalent to two full years beyond the degree of Master of Arts or Master of Science (one full year beyond the degree of Master of Education), and (2) a field study or other professional type of investigation. A candidate for the degree of Doctor of Education must have completed the requirements for the degree of Master of Education, or the equivalent. Toward the end of his second year or, by special permission, at the beginning of his third year of graduate study, a student who wishes to become a candidate for the degree of Doctor of Education must submit to preliminary examinations conducted by a committee appointed by the Dean of the Graduate College. The graduate faculty will advise a student not to attempt these examinations if the evidence does not indicate promise of outstanding professional competence.

During the third year of residence, the candidate, having completed the requirements for the degree of Master of Education, or the equivalent, and having passed the required preliminary examinations, must conduct a field study or other type of professional investigation, the report of which will constitute the thesis for the degree. This study will consist of a scholarly investigation of a significant professional problem.

The topic of the study, selected in consultation with the student's advisory committee, must be announced before the third year of graduate residence may begin. The study must have the approval of the graduate faculty of the College of Education and of the Executive Faculty of the Graduate College.

The third year of residence for candidates who are employed in professional work during the school year may be accomplished as follows:

The candidate will devote a minimum of three summer sessions and two academic years to the field study or the professional investigation. The candidate

will begin the first academic year of his study immediately after the completion of the first summer session. He will register during both semesters in a special seminar for candidates for the degree of Doctor of Education. This seminar will require a minimum of three days each semester at the University. The candidate will be expected to demonstrate continued progress in the organization, planning, and execution of the study. For the second year of the study the requirements will be similar to those of the first year and will include resident study during the summer session, devoted primarily to reading directed by the candidate's advisor, and followed by work in the field during the succeeding academic year. The third summer session in residence will be devoted primarily to the completion of the written report of the study which shall constitute the thesis for the degree of Doctor of Education.

Candidates for the degree of Doctor of Education who already hold the degree of Doctor of Philosophy from a recognized university will be regarded as special cases. They will be required to take the prescribed seminars and such other courses as the advisory committee may require. They will also take the preliminary examinations and conduct a field study or other type of professional investigation.

At least two weeks before the time the degree is to be conferred, the candidate must submit to a final examination given by a committee appointed by the Dean of the Graduate College. This examination will deal primarily with the report of the thesis study, but will not be confined to that. It will be so conducted as to determine whether the candidate has a thorough and mature understanding of the field of education as a whole. The student may, in addition, be required to take any other examination, oral or written, that is thought proper by the various departments in which he has studied. The final examination may not be divided, but must be taken all at one time, even though this may require several sessions.

Two typewritten copies of the complete thesis in final form, the original on thesis paper and the first carbon on plain paper of approximately the same weight, must be deposited in the office of the Dean of the Graduate College for presentation to the examining committee not later than two weeks prior to the final examination and not less than four weeks before the time when the degree is to be conferred. With respect to form and to all other requirements, the regulations of the Graduate College covering theses for the Ph.D. degree will apply also to the report of the study for the Ed.D. degree.

Extramural Courses

Information concerning extramural graduate courses in education may be obtained from the Dean of the Division of University Extension, 118 Illini Hall.

Graduate Teaching Faculty

Professors: W. B. Spalding (Dean of the College of Education), K. D. Benne, T. E. Benner, G. M. Blair, R. B. Browne, R. W. Burnett, F. G. Cornell, J. J. DeBoer, G. P. Deyoe, E. W. Dolch, C. R. Griffith, H. M. Hamlin, H. C. Hand, W. V. Kaulfers, S. A. Kirk, A. B. Mays, W. S. Monroe, C. W. Odell, E. F. Potthoff, E. H. Reeder, B. O. Smith, W. Van Til.

Associate Professors: F. H. Finch, K. B. Henderson, W. P. McLure, P. V. Miller, C. W. Sanford, H. A. Schultz, J. H.

Shores, R. H. Simpson, M. R. Sumption, J. L. Trump, Letitia Walsh.

Assistant Professors: A. W. Anderson, W. R. Dixon, W. E. Harnish, J. T. Hastings, C. G. Knapp, Liesette J. McHarry, G. W. Reagan, W. O. Stanley, Celia B. Stendler, R. E. Wochner.

Instructor: Marian C. Quinn.

Courses for Graduates

400. Philosophy of Education. Based on Dewey's *Democracy and Education,* this course is a critical examination of experimentalist philosophy in its bearings on educational problems; nature and aims of education in a democratic society; relation of the individual to society; interest and discipline; play and work; freedom and control; subject matter and method. I, II; 1 unit. Mr. Benne, Mr. Browne, Mr. Stanley.

401. Modern Theories of Education. A critical analysis and examination of the theories of education represented by the work of Robert M. Hutchins, Henry C. Morrison, The Harvard Committee, and William H. Kilpatrick. II; 1 unit. Mr. Benne, Mr. Stanley.

402. Social Foundations of Education. An introductory survey of the interrelationship between school and society and of the impact on public education of the major social trends and forces operating in our society. I; 1 unit. Mr. Benne, Mr. Stanley.

403. The Historical Foundations of American Educational Thought. A study of the evolution of educational theories and philosophies since the eighteenth century, with particular reference to their impact upon educational developments in the United States. These philosophies will be studied in relation to their times, but attention will be given to their influence on present educational thought and practice. II; 1 unit. Prerequisite: Education 300 or 302, or consent of instructor. Mr. Anderson.

404. Seminar in Educational Classics. Reading and group discussion of a limited number of the most important educational writings which have had a profound influence on the progress of educational thought and practice. I; 1 unit. Prerequisite: Education 302 or 400, or consent of instructor. Mr. Benne.

405. The School and Society. I, II; 1 unit. Prerequisite: Master's degree; Education 302, 400, and 409; admission to candidacy for the Ed.M. or Ed.D. degree, or consent of instructor and admission to candidacy for the Ph.D. in Education. Mr. Anderson, Mr. Benne, Mr. Smith, Mr. Stanley.

406. The School and Society. I, II; 1 unit. Prerequisite: Master's degree; Education 302, 400, and 409; admission to candidacy for the Ed.M. or Ed.D. degree, or consent of instructor and admission to candidacy for the Ph.D. in Education. Mr. Anderson, Mr. Benne, Mr. Smith, Mr. Stanley.

409. Advanced Educational Psychology. An advanced course in the psychology of teaching and learning designed especially for experienced teachers and administrators and those who desire to pursue graduate study in the field

of education. I, II; 1 unit. Mr. Blair, Mr. Dixon, Mr. Dolch, Mr. Potthoff, Mr. Simpson.

410. Mental Hygiene and the School. A study of normal personality, integration, feelings of inferiority, adjustment mechanisms, classroom therapy, behavior disorders in children, and the mental hygiene of the classroom. I, II; 1 unit.

411. Psychology of Adolescence for Teachers. The psychological significance of adolescence, its biological and social foundation, and its implications for education. I, II; 1 unit. Prerequisite: Psychology 100; Education 109 and 409. Mr. Blair.

414. Seminar in Educational Psychology. A course for advanced students in educational psychology. Provision is made for the student to conduct under the supervision of the instructor an individual research project or special study of one or more significant psychological problems. I, II; 1 unit. Prerequisite: Education 409, 410, and 411. Mr. Blair, Mr. Dolch, Mr. Finch, Mr. Kirk, Mr. Potthoff, Mr. Simpson.

415. Education and the Individual. I, II; 1 unit. Prerequisite: Master's degree; Education 409; admission to candidacy for the Ed.M. or Ed.D. degree, or consent of instructor and admission to candidacy for the Ph.D. in Education. Mr. Blair.

417. Administration and Supervision of Education of Exceptional Children. An eight-week course for elementary school supervisors, principals, and superintendents and for supervisors of special education classes. Study of the research dealing with physical, mental, emotional, and social traits of all types of exceptional children. Discussion of the special school provisions needed for their education and development. The course will also include an analysis of the methods of selection of children for special training, buildings and equipment needed by teachers for each type, state laws pertaining to exceptional children, and financing and administration. For the first four weeks members of the class will devote part of their time in observation in the workshop. S; 1 unit. Mr. Kirk.

418. Seminar in the Education of Exceptional Children. A seminar dealing with problems in administration, supervision, philosophy, organization, recent research developments, and federal and state legislation dealing with exceptional children. I; 1 unit. Prerequisite: Education 317 and 318, or consent f instructor. Mr. Kirk and others.

425. Educational and Vocational Guidance. A study of the basic principles of guidance, and the means by which these principles can be applied in dealing with problems of educational and vocational adjustment as they occur in the school. I, II; 1 unit. Mr. Finch.

426. Diagnostic and Remedial Programs of the School. A study of remedial programs in personality, reading, spelling, English, arithmetic, handwriting, and content subjects. I, II; 1 unit. Mr. Dolch.

427. Seminar in Educational and Vocational Guidance. An advanced course open only to students with a background in principles of guidance. Each member of the class will select and work intensively on a problem which

requires the collection and analysis of the types of data necessary to effective counseling. Reports will be presented in such a manner that all members of the class participate in studying the utilization of these data. S; 1 unit. Prerequisite: Education 409 and 425; consent of instructor. Mr. Finch.

428. The Analysis and Use of Occupational Information in Guidance Programs. Deals with the results of recent occupational research, and with the use of these results by teachers and counselors. Attention will also be given to research techniques suitable for use in local occupational studies. S; ½ to 1 unit. Prerequisite: Education 425, or consent of instructor.

430. Elementary School Organization and Administration. I; 1 unit. Mr. Reeder.

431. Programs for Children in the Kindergarten-Primary Grades. Basis of program-making in the kindergarten-primary grades; recent developments of promise in the field; utilization of resources of art, music, science, social studies in planning for young children. I or II; 1 unit. Prerequisite: Education 334, or consent of instructor. Mrs. Stendler.

434. Curriculum Problems and Trends in Elementary School Reading and the Language Arts. I, II; 1 unit. Mr. Shores.

435. Curriculum Problems and Trends in Elementary School Social Studies. I; 1 unit. Mr. Reeder.

438. Supervision of the Elementary School. II; 1 unit. Mr. Reeder.

439. Seminar in Elementary Education. S; 1 unit. Mr. Reeder, Mr. Shores, Mrs. Stendler.

440. Administration of Junior and Senior High Schools. I; 1 unit. Mr. Trump.

441. Supervision of Junior and Senior High Schools. II; 1 unit. Prerequisite: It is desirable for the student to have had Education 440. Mr. Trump.

442. Junior College. I; 1 unit. Prerequisite: Education 458 (the junior college section). Mr. Clevenger.

443. Trends and Techniques of Curriculum Making. Foundations of curriculum development with emphasis on cultural interpretation of history and proposed curricula. I; 1 unit. Mr. Miller, Mr. Smith.

444. Curriculum Development in Secondary Schools. Need for curriculum development; building an effective readiness and organizing for maximum breadth of participation in curriculum development; defining the pattern for the core and specialized curricula; developing source units and other guides for learning experience providing evaluative devices for new materials and procedures; providing for continuing improvement. II (first eight weeks); 1 unit. Prerequisite: Education 443. Mr. Hand.

445. Curriculum Problems and Trends in the Teaching of High School Science. A critical study of problems and trends in science curricula growing out of analysis of the function and responsibility of the science trained teacher in modern schools. Open to graduates and to advanced undergraduates with permission of the instructor. I, II; 1 unit. Prerequisite: Adequate background in the natural sciences; Education 240 and 302; consent of instructor. Mr. Burnett.

446. Curriculum Problems and Trends in the Teaching of Secondary School Social Studies. The major group experience will be working together on a project of common concern. The social realities of the culture, the needs of youth, and values will be explored early in the course. Trends studied, problems encountered, and theories developed will then be put into practice in group building of a resource unit focused on a selective center of experience. I, II; 1 unit. Prerequisite: Education 109, 240, 231 and 241, or their equivalents in other universities, or consent of instructor. Mr. Van Til.

447. Curriculum Problems and Trends in the Teaching of English. A study of the place of the English language arts in the emerging secondary school curriculum, with a review of recent trends in elementary school language arts instruction; an examination of reports of national, state, and local curriculum committees in the field of English, completed or in progress; review of research studies in English instruction. I, II; 1 unit. Prerequisite: Experience in teaching in the secondary school, supervisory or administrative experience in English, or consent of instructor. Mr. DeBoer.

448. Curriculum Problems and Trends in the Teaching of Foreign Language. A course for prospective teachers, teachers in service, department heads, curriculums coordinators, and supervisors and directors of instruction, giving critical attention to the applications of research and experimentation in the foreign languages at different levels of schooling. II; 1 unit. Prerequisite: Completion of minor in a foreign language. Mr. Kaulfers.

449. Curriculum Problems and Trends in the Teaching of Mathematics. The course is designed primarily for experienced teachers of secondary school mathematics. It considers problems of selection of content, organization of courses, and correlation of mathematics courses with other subjects in the light of the nature of mathematics and the needs of secondary school students. II; 1 unit. Prerequisite: Undergraduate courses leading to a teaching certificate. Mr. Henderson.

451. Supervision in Home Economics Education. The philosophy, principles, and techniques of pre-service and in-service training of teachers of home economics. Organization, administration, evaluation, and possible future improvement of existing programs. Class visitation and other techniques practiced; supervisory materials prepared. I; 1 unit. Prerequisite: Required undergraduate courses in home economics education. Miss Walsh.

452. Curriculum Problems and Trends in Home Economics Education. A study of the impact of socio-economic forces on family life today and of the promising practices currently being developed in curriculum building, techniques of teaching and evaluation, and school-community programs to meet students' needs for purposes of both general and vocational education in home economics. Preparation of instructional materials parallels this study. I; 1 unit. Miss Walsh.

453. Seminar in Home Economics Education. A course designed to prepare "consumers of research" through a comprehensive study and evaluation of home economics investigations now available and through the experience of carrying out an individual investigation that is necessarily limited in scope but complete and sound in all procedures. II; 1 unit. Prerequisite: First-year graduate standing. Miss Walsh.

454. Logical Foundations of Methods. Application of principles of logic to methods of instruction. I, II; 1 unit. Prerequisite: Philosophy 102, or consent of instructor. Mr. Smith.

455. Adult Education in Community Schools. The organization, procedures, and administrative considerations of adult education in community schools. S; 1 unit. Prerequisite: Education 109 and 240, or equivalent.

457. Seminar in Curriculum Problems. II; 1 unit. Mr. Smith.

458. Seminar in Secondary Education. I; 1 unit. Prerequisite: Any four of the following: Education 425, 440, 441, 442, 443 or 444, 495 or 496. Mr. Hand.

459. Workshop in Curriculum Development. This workshop is primarily designed to meet the needs of the schools in Illinois that are participating in the cooperative curriculum development study jointly sponsored by the Office of the Superintendent of Public Instruction and the Illinois Association of Secondary School Administrators. Registration will not be limited to personnel from these particular schools, however. S; 1 to 2 units. Staff.

460. Educational Administration. A course to provide the basic common understanding of theory and practice in American educational administration which should be expected of teachers, supervisors, and administrative officers. I, II; 1 unit. Mr. Benner, Mr. Miller, Mr. Trump.

463. Principles of Educational Leadership. This course includes a selective examination of those aspects of philosophy, psychology, and sociology out of which are drawn the principles which underlie democratic leadership. Attention will be directed toward the application of these principles in school systems. I, II; 1 unit. Prerequisite: Education 400, 405, 406, and 409, or their equivalents as determined by conferences with the instructor. Mr. Spalding.

464. Current Problems in School Administration. Practicum in school administration for administrators in service. The course is designed to give direct help on local problems, to serve as a refresher course, and to bring the administrator up to date on recent developments in school administration. S; 1 to 2 units. Mr. Clevenger, Mr. McLure, Mr. Miller, Mr. Sumption, Mr. Wochner.

465. Public School Finance and Business Administration. The theory and practice of financing public education in the United States. Development of guiding principles in educational finance, trends and needs in state and federal participation in school support, and local operational finance. II; 1 unit. Prerequisite: Education 460. Mr. McLure.

466. Seminar in School Administration. A course for advanced students in educational administration. Students under supervision of staff members will conduct individual research studies or special projects on one or more significant aspects of educational administration. I; 1 unit. Prerequisite: Three units of graduate work in education including Education 460. Mr. Benner, Mr. Cornell, Mr. Miller, Mr. Sumption.

467. The American College. Development of the American college and university, public and private; conflicting theories; present trends. II; 1 unit. Mr. Benner.

468. Public Relations of the Schools. I, II; 1 unit. Mr. Benner.

469. Legal Basis of School Administration. The legal rights, privileges, responsibilities, immunities, and authority of pupils, parents, teachers, administrators, and school board members in relation to the school. II; 1 unit. Mr. Sumption.

471. Planning Programs of Agricultural Education in the Community Schools. The community school concept, applications to agricultural education; relationships of agricultural education to community study and planning; using advisory councils and committees; objectives; evaluation; program planning; school and community relationships; planning department management and facilities. I; ½ unit. Prerequisite: Agricultural Education 276 and 277. Mr. Hamlin.

472. The High School Program in Agricultural Education. Place of agriculture in the high school; the program in vocational agriculture for high school students; coordination of classwork, supervised farming, and FFA; development of course materials; teaching procedures and aids; conducting FFA; guidance and follow-up facilities; non-vocational agriculture. I; ½ unit. Prerequisite: Agricultural Education 276 and 277. Mr. Deyoe.

473. Vocational Education in Agriculture for Adults. The case for adult education; adult education in the public schools; needs of young and adult farmers for education; development and present status of adult education in agriculture; objectives and evaluation; using advisory committees, organizing adult classes; enrolling students; course planning; supervised practice; group activities; facilities. II; ½ unit. Prerequisite: Agricultural Education 276 and 277. Mr. Hamlin.

474. Supervised Farming in Vocational Agriculture. Importance and meaning of supervised farming; evaluation of supervised farming; relation to establishment in farming; selecting and planning; records; related instruction; supervision; nature of supervised farming for persons in day-school, young-farmer, and adult-farmer classes. I, II; ½ unit. Prerequisite: Agricultural Education 276 and 277. Mr. Deyoe.

477. Field Studies in Agricultural Education. Studies related to Education 471, 472, 473, or 474. Open only to students who have completed one or more of these courses and who have submitted satisfactory plans for studies related to course or courses completed. Instructor assists students in the schools where they are employed. One campus conference required each semester. I, II; ½ unit. Prerequisite: Education 471, 472, 473, or 474. Mr. Deyoe, Mr. Hamlin.

478. Seminar in Agricultural Education. Needs for, and contributions of, research in agricultural education, review and criticism of research studies, planning of a comprehensive study or completion of a small study. I; ½ unit. Prerequisite: Two graduate courses in agricultural education. Mr. Hamlin.

481. History and Fundamental Concepts of Vocational Education. A course in the historical development of modern vocational education, the educational theories underlying its development, and the educational concepts upon which present programs and procedures are based. I; 1 unit. Mr. Mays.

482. Research in Industrial Education. Study and evaluation of examples of research in this field; a consideration of the research needed to solve present problems. Each student will propose and complete a brief research, or plan in detail a major research project to be completed later. II; 1 unit. Mr. Dodge.

487. Seminar in Industrial Education and Vocational Guidance. II; ½ to 1 unit. Mr. Dodge.

488. Curriculum Problems and Trends in Industrial Education. Selection and organization of instructional materials for industrial courses. Study of basic concepts underlying course construction in industrial education. II; 1 unit. Prerequisite: Undergraduate work in industrial education. Offered in 1948-1949 and in alternate years. Mr. Mays.

489. Administration and Supervision of Industrial Education. Problems and approved practices in the Administration and supervision of programs of industrial education in the secondary schools. II; 1 unit. Prerequisite: Undergraduate work in industrial education. Offered in 1949-1950 and in alternate years. Mr. Mays.

491. Thesis. Only students of superior scholarship are permitted to register in this course. The student must present in writing an outline describing the proposed thesis. This outline, when approved by the faculty member under whose direction the thesis is to be written, must be submitted to the dean of the college for his approval. I; ½ to 4 units. Mr. Spalding and others.

492. Thesis. Only students of superior scholarship are permitted to register in this course. The student must present in writing an outline describing the proposed thesis. This outline, when approved by the faculty member under whose direction the thesis is to be written, must be submitted to the dean of the college for his approval. II; ½ to 4 units. Mr. Spalding and others.

493. Research in Education. Students who wish to register in this course are required to present in writing a proposal describing the research project which they wish to undertake. This proposal, when approved by the faculty member under whose direction the research is to be done, must be submitted to the dean of the college for his approval. I; 1 unit. Prerequisite: Three units of graduate credit in education. Mr. Spalding and others.

494. Research in Education. Students who wish to register in this course are required to present in writing a proposal describing the research project which they wish to undertake. This proposal, when approved by the faculty member under whose direction the research is to be done, must be submitted to the dean of the college for his approval. II; 1 unit. Prerequisite: Three units of graduate credit in education. Mr. Spalding and others.

495. Educational Measurements. Objectives and scope of educational measurement; selection of standard tests; construction of informal tests; marking; uses of test results are the chief topics. Tests of achievement, intelligence, and personality, and other types of measurement are included. II; 1 unit. Mr. Odell.

496. Educational Statistics. Designed to cover such procedures and applications as are most often needed by school administrators, teachers, and other

educational workers and as a basis for further work by advanced graduate students. I, II; 1 unit. Mr. Odell.

498. Techniques of Educational Research. I, II; 1 unit. Mr. Cornell.

499. Advanced Seminar. A course designed for students who are in their third year of graduate study and who are working on theses for the Doctor of Education degree. I, II; no credit. Prerequisite: Two years of professional study and passing of preliminary examinations. Mr. Finch.

Courses for Graduates and Advanced Undergraduates

300. The History of Education. A brief, introductory survey of ancient and medieval education followed by a more extended study of educational developments since the Italian Renaissance. Special emphasis is placed on the relation of educational trends to broader social, economic, political, and intellectual movements. I, II; 3 hours, or ½ unit. Prerequisite: Junior standing. Mr. Anderson, Mr. Connell.

301. Ancient and Medieval Education. A study of educational thought and practice in ancient Greece and Rome and in the Middle Ages. Emphasis is placed on the relation of education to the intellectual and social conditions of the periods. I; 2 hours, or ½ unit. Graduate students may earn 1 unit of credit by special arrangement with the instructor. Prerequisite: Education 300, or consent of instructor. Mr. Anderson.

302. History of American Education. The development of American education in relation to political, social, and cultural developments. Special attention is given to the influence of movements in the cultural environment on evolving conceptions of educational theory and practice. I, II; 2 or 4 hours, or ½ to 1 unit. Prerequisite: Junior standing; Education 300 is a desirable preparation but not required. Mr. Anderson, Mr. Kaulfers.

315. Sociology of Education. Same as Sociology 315. Objective comparative study of education as a social process in various cultures and historical periods, with main emphasis on present education in countries which share western civilization. I or II; 3 hours, or ½ unit. Prerequisite: Sociology 100; junior standing. Mr. Znaniecki.

317. Exceptional Children. An introduction to the study of children who deviate from the average in mental, physical, and social characteristics. The course will include a study of the characteristics of such children and the adaptation of educational procedures to their abilities and disabilities. I, II; 3 hours, or ½ unit. Graduate students may earn 1 unit of credit by special arrangement with the instructor. Prerequisite: Psychology 100; junior standing. Mr. Kirk.

318. Workshop and Laboratory in Education of Exceptional Children. Observation of special laboratory classes of various types of exceptional children. Group discussions. Conferences with specialists as consultants. Work on a project of particular interest to the individual student. S; 4 hours, or 1 unit for four weeks; 8 hours, or 2 units for eight weeks. Prerequisite: Senior standing. Mr. Kirk and others.

319. Special Education of the Deaf. Survey of the curriculum and techniques in preschools, kindergartens, primary, and intermediate levels as applied to the hard-of-hearing, deafened, and deaf child. A study of sense training, lip reading, vocabulary development, reading techniques, language and speech development, auditory training, and curriculum construction. I; 5 hours, or 1 to 1½ units. Prerequisite: First three years of curriculum for teachers of the deaf, or equivalent. Miss Quinn.

320. Special Education of the Deaf. Continuation of Education 319. II; 5 hours, or 1 to 1½ units. Prerequisite: Education 319. Miss Quinn.

321. Care and Education of Orthopedically Handicapped Children. Survey of orthopedic handicaps in children, psychological and social effects of such handicaps, and the kinds of schools and services provided for the education of the various types of crippled children. The education of the cerebral palsied child will be emphasized. S; 4 hours, or 1 unit. Prerequisite: A teacher's certificate, or senior standing, or a major in some area of special education. Offered in 1949-1950 and in alternate years.

322. Psychology and Education of the Mentally Handicapped. A study of the social, emotional, physical, and learning characteristics of mentally handicapped children; methods of diagnosis and differentiation; educational organization and teaching techniques employed for their rehabilitation. I; 3 hours, or ½ to 1 unit. Prerequisite: Education 231; senior standing. Miss Flach, Mr. Kirk.

323. Psychology and Education of the Mentally Handicapped. Continuation of Education 322 with emphasis on curriculum. II; 3 hours, or ½ to 1 unit. Prerequisite: Education 322. Miss Flach, Mr. Kirk.

330. Curricular Development in Elementary Schools. Sources of curricular objectives with respect to the elementary school level; special treatment of objectives and methods in the elementary school subjects. I; 2 hours, or ½ unit. Prerequisite: Education 109 and 230; senior standing. Mr. Shores.

331. Special Problems in Elementary Curriculum. Individual investigation and report of specific problems in area of Education 330. I; 2 hours, or ½ unit. Prerequisite: Registration in Education 330; consent of instructor required for undergraduates. Mr. Shores.

332. Development of Teaching Units in the Elementary School. Techniques for the development of teaching units as a method of improving instruction in the elementary school. II; 2 hours, or ½ unit. Prerequisite: Education 109 and 230; senior standing. Mr. Shores.

333. Special Problems in Elementary Teaching. Individual investigation and report of specific problems in area of Education 332. II; 2 hours, or ½ unit. Prerequisite: Registration in Education 332; consent of instructor required for undergraduates. Mr. Shores.

334. Child Development and Implications for Education. Mental, emotional, and social development of children from birth to sixteen with emphasis on developmental, cultural, and mental hygiene factors as they apply in the elementary school. Application of principles of child growth to present-day curricular problems. I; 2 hours, or ½ unit. Graduate students may earn

1 unit of credit by special arrangement with the instructor. Prerequisite: Education 109; senior standing. Mrs. Stendler.

335. Science in the Elementary School. The organization of science context and experiences for elementary school children. No science background is assumed for students in this course. Opportunity will be possible for the construction and use of simple demonstration materials. II; 3 hours, or ½ unit. Mr. Burnett.

350. Curriculum Problems and Trends in Art Education. A critical examination of recent developments and studies in the curriculum, the nature of creative activity, materials of instruction, evaluation, and visual aids. Attention is given to the practical application of current trends to the teaching of art in the elementary and secondary schools. II; 2 hours, or ½ unit. Prerequisite: Undergraduate major in art education, or experience as a teacher or supervisor of art in either elementary or secondary schools, or consent of instructor.

354. Audio-Visual Materials and Problems. Audio-visual materials will be examined from the point of view of their effectiveness and possible utilization in the school program. Recent investigations on materials and methods of presentation will be studied to ascertain their pedagogical implications. The technical and administrative problems of integrating audio-visuals into the school curriculum are considered. S; 2 hours, or ½ unit. Graduate students may earn 1 unit of credit by special arrangement with the instructor. Prerequisite: Education 109, 231 and 241; senior standing. Mr. Peterson.

381. Principles of Vocational Education. Same as Industrial Education 381. Study of basic concepts and practices of modern vocational education. I, II; 3 hours, or ½ to 1 unit. Mr. Mays.

383. Problems of Industrial Education. Same as Industrial Education 383. A survey of the problems and practices of the several phases of industrial education. I, II; 3 hours, or ½ to 1 unit. Mr. Mays.

385. Principles of Vocational Guidance. Same as Industrial Education 385. Basic concepts and practices of vocational guidance in public schools. What the teachers can do in vocational guidance. I, II; 3 hours, or ½ to 1 unit. Mr. Mays.

INDUSTRIAL EDUCATION

Courses for Graduates

For graduate courses in Industrial Education, see Education 481, 482, 487, 488, 489.

Courses for Graduates and Advanced Undergraduates

381. Principles of Vocational Education. Same as Education 381. Study of basic concepts and practices of modern vocational education. I, II; 3 hours, or ½ to 1 unit. Mr. Mays.

383. Problems of Industrial Education. Same as Education 383. A survey of the problems and practices of the several phases of industrial education. I, II; 3 hours, or ½ to 1 unit. Mr. Mays.

385. Principles of Vocational Guidance. Same as Education 385. Basic concepts and practices of vocational guidance in public schools. What the teachers can do in vocational guidance. I, II; 3 hours, or ½ to 1 unit. Mr. Mays.

ELECTRICAL ENGINEERING

Graduate work in electrical engineering leading to the degree of Master of Science in Electrical Engineering and Doctor of Philosophy in Engineering is offered to graduates of electrical engineering curricula substantially equivalent to that of the University of Illinois in the option in which advanced work is desired. The fields of specialization are communication and electronics, illumination, and power. Graduates of curricula in the physical sciences and mathematics may also be admitted to advanced study if they have the necessary background to profit from graduate work in electrical engineering.

Courses for advanced undergraduates and graduates are also open for credit to students with a major in other departments, who have the proper prerequisites.

The objectives of a well-rounded graduate program in electrical engineering can be developed in four areas:

(a) The development of a more thorough understanding of the basic fundamentals of electrical engineering.

(b) Development of better tools for the solution of electrical engineering problems.

(c) Uncovering of the special characteristics of initiative and resourcefulness.

(d) Development of a specialist's understanding in some area of the electrical engineering field.

No standard program can be set up which will fit the needs of all graduate students. The varying maturity and purposefulness of graduate students will require individuality in their programs.

To help determine the program, each student takes a written placement examination in electrical engineering to determine the extent of his background. This examination is diagnostic in character, and the results are expected to provide suggestions for further study, either formal or informal. With the help of the diagnostic examination, a faculty advisor is appointed for each entering graduate student. The advisor and the student together work out the program which the student is to follow.

It is expected that the student will enroll in such additional mathematics work as a review of his training and the field in which he specializes would indicate advisable. Advanced courses in mathematics, physics, chemistry, mechanics, and in other branches of engineering are suggested as suitable minor subjects.

Communication and Electronics. It is recommended that graduate students specializing in this field acquire a general knowledge of the whole field as well as a specialized knowledge of some part of it. Therefore, it is suggested that Electrical Engineering 410, 420, 422, and 423 be taken as early in the program as possible.

For students interested in industrial electronics, it is suggested that Electrical Engineering 410, 413, 429, 430, and 442 as well as mechanical engineering courses in mechanism and machine design be included in a well-rounded course of study.

For graduate work in communication and electronics, the student should offer the equivalent of the following undergraduate courses: Electrical Engineering 330

and 331, Electrical Machinery; 342, 343, 344, and 345, Electronics; 350 and 351, Communication Networks and Lines; 352 and 353, Communication Engineering; Differential Equations.

Students with deficiencies must expect to satisfy these requirements.

Illumination. The courses in illumination are designed to develop an analytic basis for illumination engineering, rather than develop the theory of light and photometry. Mathematical analysis is applied to illumination design and the answers are compared with the results found in practice.

It is suggested that Electrical Engineering 410, 460, and 461 be taken as early in the program as possible and that the student also include vector analysis during the course of his work. Research work may be in the theory and practice of illuminating engineering or colorimetry.

For graduate work in illumination, the student should offer the equivalent of the following undergraduate courses: Electrical Engineering 120, Illuminating Engineering and Secondary Power Distribution; 320 and 321, Introduction to Circuit Analysis; 330 and 331, Electrical Machinery; 340 and 341, Electronics; Differential Equations.

It is expected that the student will have some preparation in light, physiology, and psychology. Students with deficiencies must expect to satisfy these requirements.

Power. The graduate work in power option falls naturally into the fields of circuits, machinery, and power systems. To provide a suitably broad base, and assure adequate preparation for the courses to follow, it is suggested that Electrical Engineering 410, 440, 442, and 444 be taken as early in the program as possible.

For graduate work in power, a student should offer the equivalent of the following undergraduate courses: Electrical Engineering 332, 333, 334, and 335, Alternating Current Apparatus; 336 and 337, Direct Current Apparatus; 387, Electrical Design; 340 and 341, Electronics; Differential Equations..

Students with deficiencies must expect to satisfy these requirements.

The courses listed below indicate by their content the general field to which they belong. It is recognized that the candidate for the master's degree would not take all of the courses in a particular field, while a candidate for the doctor's degree might expand the listing through a study of special problems. To provide broadness as well as depth, a student should include some courses which are not in his chosen option.

Fellowships and Prizes

Galvin Fellowship. One fellowship is offered annually by Motorola, Inc., of Chicago, to a graduate student in electrical engineering majoring in the field of radio engineering. It is awarded wth a stipend of $750 on recommendation of the Department of Electrical Engineering.

Westinghouse Fellowship. One fellowship is offered annually by the Westinghouse Educational Foundation, Pittsburgh, Pennsylvania, to a graduate student in electrical engineering. It is awarded with a stipend of $1,000 upon recommendation of the Department of Electrical Engineering.

Other industrial fellowships are available from time to time.

American Institute of Electrical Engineering (Urbana Section) Prize. The Urbana Section of the American Institute of Electrical Engineering annually offers awards totaling $25 for the best papers submitted by graduate students in Electrical Engineering in a competition usually held in the spring of the year.

Graduate Teaching Faculty

Professors: W. L. Everitt (Head of Department), L. T. DeVore, M. A. Faucett, G. H. Fett, E. C. Jordan, J. O. Kraehenbuehl, C. A. Keener, A. R. Knight, M. B. Reed, A. L. Samuel.

Associate Professors: L. B. Archer, H. N. Hayward, M. S. Helm, C. E. Skroder.

Assistant Professors: A. D. Bailey, R. S. Elliott, W. J. Fry, H. W. Horn, R. S. Julian, W. E. Miller, T. A. Murrell, P. F. Schwarzlose, N. Wax.

Courses for Graduates

400. Seminar. Required of all graduate students. I, II; no credit. Mr. Everitt.

410. Engineering Analysis. Static and dynamic field problems with emphasis on the relationships between the various branches of engineering and the development of the use of mathematics as a tool in the solution of complex problems. I, II; 1 unit. Mr. Hessler.

412. Advanced Engineering Measurements. Theory and practice of precision measurements of electric, magnetic, and physical quantities; factors influencing the choice of method. Comparative accuracy and practicability of measurement methods and limitation of technique; evaluation of errors; design and development of measurement apparatus and methods. I, II; 1 unit. Mr. Hayward.

413. Servomechanisms and Automatic Control Devices. Fundamental theory of servomechanisms and other automatic control devices, electrical analogies, stability, transfer functions, and on-off mechanisms. I, II; 1 unit. Mr. Fett.

414. Matrix Algebra Applied to Electrical Networks. A critical appraisal of the application of tensors to electrical networks followed by matrix algebra applications. I; 1 unit. Mr. Reed.

420. Electromagnetic Waves and Radiating Systems. Fundamental electromagnetic theory with applications to transmission lines, wave guides, and antennas. I, II; 1 unit. Mr. Jordan.

421. Advanced Electromagnetic Engineering. Cylindrical and spherical electromagnetic waves; radiation and diffraction; advanced antenna theory; ground and sky wave propagation. I, II; 1 unit. Prerequisite: Electrical Engineering 420. Mr. Jordan.

422. Advanced Communication Networks. Fourier integral and matrix algebra, analysis of networks, and network synthesis for wide band operation. I, II; 1 unit. Mr. Everitt.

423. Electron and Ion Dynamics. Laplace equation, conformal transformations, Poisson's equation with initial velocities and transit time, electron optics, and electron ballistics of klystrons and magnetrons. I, II; 1 unit. Prerequisite: Credit or registration in Electrical Engineering 420. Mr. Samuel.

424. Theory of Gaseous Discharge Devices. Motion of ions and electrons; ionization and deionization; space charge and plasma; glow and arc discharges; circuit interruption; arc extinction problems. I, II; 1 unit. Mr. Fett.

425. Photoelectric and Thermionic Phenomena. Experimental basis for thermionics, thermoelectricity, and photoelectricity; thermodynamics of electron emission and thermoelectricity; basis of quantum statistics and application to thermionics and photoeffect. I, II; 1 unit. Mr. Murrell.

426. Electroacoustical Systems. A study of the solutions of differential equations of wave motion with applications to vibrating strings, membranes, rods, sonic systems, loud speakers, microphones, galvanometers. I, II; 1 unit. Mr. Fry.

427. Boundary Value Problems. Derivation and solution of partial differential equations and integral equations of mechanics and electricity and magnetism; study of the analysis of wave motions. I, II; 1 unit. Mr. DeVore.

428. Nonlinear Oscillating Systems. Criteria for stability of nonlinear oscillations; nonlinear resonance; study of analytical methods; harmonics and subharmonics, and relaxation oscillations. I, II; 1 unit. Mr. DeVore.

429. Vacuum Tube Circuit Analysis. Vacuum tube network theory, feedback circuits and amplifiers, stability, equalizers, and relations between components of network functions. I, II; 1 unit. Mr. Fett.

430. Gas Tube Circuit Analysis. Equivalent circuit of gas tubes at low and high frequencies, circuit analysis, and rectifiers. II; 1 unit.

431. Microwave Circuits. Four terminal networks and transmission line theory, bilinear transformations, wave guides, the generalized impedance concept, expansion of fields in normal modes, resonant cavities, and measurement techniques. I, II; 1 unit. Prerequisite: Electrical Engineering 420. Mr. Samuel.

432. Passive Network Design: Real Frequency Techniques. A study of the methods of electrical network synthesis as developed by Gewertz, Brune, Cauer, Bode, and Darlington on a real frequency basis. II; 1 unit. Mr. Reed.

433. Transmission of Information. II; 1 unit. Prerequisite: Electrical Engineering 422. Mr. Wax.

440. Advanced Power Circuit Analysis I. Special methods of polyphase circuit analysis, transients in multiple loop lumped constants, circuits by differential equations and by Heaviside expansion theorem, and study of circuits having nonlinear parameters by step-by-step method. I, II; 1 unit. Mr. Knight.

441. Advanced Power Circuit Analysis II. Transients in multiple loop lumped constant circuits by Fourier integral and by Laplace transforms, and study of steady state relations and transients in distributed constant circuits. I, II; 1 unit. Prerequisite: Electrical Engineering 440. Mr. Knight.

442. Advanced Analysis of Alternating Current Machinery. Steady state analysis of synchronous machines, round rotor and salient poles, magnetomotive forces with symmetrical and unsymmetrical windings, torque angle characteristics, vibration, and noise. I, II; 1 unit. Mr. Keener.

443. Analysis of Dynamo Machines Under Transient Conditions. Analysis of the operation of alternating and direct current machines under transient conditions, armature and field phenomena and mutual reactions of dynamo machines watt system transients. I, II; 1 unit. Prerequisite: Electrical Engineering 442. Mr. Keener.

444. Advanced Power System Analysis. Electrical and mechanical properties of transmission systems, calculations of fault currents, power diagrams, and power limits. I, II; 1 unit. Prerequisite: Electrical Engineering 440. Mr. Faucett.

445. Power System Transients and Stability. Steady state power limits, criteria for loss of synchronism, effects of voltage regulation, exciters, and steady state as influenced by dynamic stability. I, II; 1 unit. Prerequisite: Electrical Engineering 444. Mr. Faucett.

446. Electrical Design (Apparatus). Properties of materials, field mapping, leakage fields, cooling and rating of apparatus, limitations affecting design, prediction of operating characteristics, and special design problems. I, II; 1 unit. Prerequisite: Preparation substantially equivalent to the power option in the undergraduate electrical engineering curriculum. Mr. Archer.

447. Electrical Design (Power System). Sources of energy, location of generating stations, selection of units, location of transmission lines, layouts of systems, and extension of established systems. I, II; 1 unit. Mr. Faucett.

460. Treatment of Experimental Illumination Data. Representation of data by tables, graphs, and equations, tabular and graphical differentiation and integration, normal frequency distribution, measure of averages, variability and relationship, indexes and adjustment of measurements. Methods applied to observations made with both light and illumination as part of human environment. I, II; 1 unit. Mr. Kraehenbuehl.

461. Methods of Illumination Calculations. Fundamentals of the light field, illumination in space, the light vector, plots of fields, and applications of light fields to engineering problems. I, II; 1 or 2 units. Mr. Kraehenbuehl.

462. Colorimetry in Illumination. Color vision, color of sources, surfaces and filters, direct measurements of spectral distributions, methods of computing tristimulus values and chromaticity coefficients, color temperature, color systems and their interrelation, linear and homogeneous transformation, color discrimination, and harmony and applications. I, II; 1 unit. Mr. Kraehenbuehl.

463. Advanced Illumination Sources. General theory of enclosures, analytical consideration of simple forms, enclosures in photometry, coefficients applied to enclosures, and comparison of calculated and applied methods. I, II; 1 or 2 units. Mr. Miller.

464. Advanced Illumination Design. Design of lighting equipment for both utility and comfort, control of glare through proper brightness contrasts, design for special applications, and design of floodlighting and streetlighting equipment. I, II; 1 or 2 units. Mr. Horn.

491. Thesis. I; ¼ to 4 units. Graduate Staff.

492. Thesis. II; ¼ to 4 units. Graduate Staff.

493. Research. I; ½ to 4 units. Graduate Staff.

494. Research. II; ½ to 4 units. Graduate Staff.

497. Electrical Engineering Problems. Special electrical engineering problems. I; ½ to 2 units. Prerequisite: Graduate standing in electrical engineering. Graduate Staff.

498. Electrical Engineering Problems. Special electrical engineering problems. II; ½ to 2 units. Prerequisite: Graduate standing in electrical engineering. Graduate Staff.

Courses for Graduates and Advanced Undergraduates

306. Direct and Alternating Current Circuits. Fundamental electric and magnetic units; direct and alternating current circuit analysis; complex numbers and vector diagram solutions. I, II; 3 hours, or 0 to ¾ unit. Prerequisite: Physics 103 and 104; Mathematics 142 or 147; credit or registration in Electrical Engineering 307. Mr. Neal and others.

307. Direct and Alternating Current Laboratory. Circuits laboratory accompanying Electrical Engineering 306. I, II; 1 hour, or 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 306. Mr. Neal and others.

308. Direct and Alternating Current Apparatus. Generators and motors, transformers, rectifiers, and electronic devices. I, II; 3 hours, or 0 to ¾ unit. Prerequisite: Electrical Engineering 306 and 307; credit or registration in Electrical Engineering 309. Mr. Neal and others.

309. Direct and Alternating Current Laboratory. Machines laboratory accompanying Electrical Engineering 308. I, II; 1 hour, or 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 308. Mr. Neal and others.

320. Introduction to Circuit Analysis. Detailed and analytical solution of periodic current circuits; special problems in alternating current networks including polyphase and coupled circuit; power and power measurement; wave analysis. I, II; 4 hours, or 0 to 1 unit. Prerequisite: Electrical Engineering 126; Physics 104; credit or registration in Mathematics 341 or 342, 343, 345, and Electrical Engineering 321. Mr. Knight and others.

321. Circuit Laboratory. Study and analysis of direct and alternating current circuits by laboratory observations and techniques. I, II; 2 hours, or 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 320. Mr. Bailey and others.

324. Measurements in Electrical Engineering. Precise measurement of electrical quantities and the application of precise measurement methods to engineering problems. I, II; 3 hours, or 0 to 1 unit. Prerequisite: Electrical Engineering 126 and 320. Mr. Hayward, Mr. Pierce, and others.

330. Electrical Machinery. Transformers, motors and generators, converters and electronic power equipment. For electrical engineering students selecting the options in communication or illumination. I, II; 4 hours, or 0 to 1 unit. Prerequisite: Electrical Engineering 320 and 321; credit or registration in Electrical Engineering 331. Mr. Williams and others.

331. Electrical Machinery Laboratory. To accompany Electrical Engineering 330. I, II; 2 hours, or 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 330. Mr. Williams and others.

332. Alternatng Current Apparatus. Transformers and generators. For electrical engineering students selecting the option in power. I, II; 4 hours, or

0 to 1 unit. Prerequisite: Electrical Engineering 320 and 321; credit or registration in Electrical Engineering 333. Mr. Helm, Mr. Keener, and others.

333. Alternating Current Apparatus Laboratory. Advanced alternating current laboratory. I, II; 2 hours, or 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 332. Mr. Reid and others.

334. Alternating Current Apparatus. Synchronous, induction, and commutator motors; rotary converters, single phase motors, special types of alternating current dynamo machines. For electrical engineering students selecting the option in power. Not open to students with credit in Electrical Engineering 330. I, II; 3 hours, or 0 to ¾ unit. Prerequisite: Electrical Engineering 332 and 333; credit or registration in Electrical Engineering 335. Mr. Helm, Mr. Keener, and others.

335. Alternating Current Apparatus Laboratory. Advanced alternating current laboratory. I, II; 2 hours, or 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 334. Mr. Reid and others.

336. Direct Current Apparatus. Theory and characteristics of standard and special direct current apparatus. I, II; 3 hours, or 0 to ¾ unit. Prerequisite: Electrical Engineering 334 and 335; credit or registration in Electrical Engineering 337. Mr. Hang, Mr. Knight, and others.

337. Direct Current Apparatus Laboratory. Analysis of the operation and characteristics of direct current rotating equipment by laboratory methods. I, II; 2 hours, or 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 336. Mr. Hang and others.

340. Electronics. High vacuum and gas filled electron tubes, circuits, and applications. For students in power and illumination options in electrical engineering. Not open to students with credit in Electrical Engineering 212, 342, or 344. I, II; 4 hours, or 0 to ¾ unit. Prerequisite: Electrical Engineering 320 and 332; credit or registration in Electrical Engineering 334 and 341. Mr. Scott and others.

341. Electronics Laboratory. To accompany Electrical Engineering 340. Not open to students with credit in Electrical Engineering 213, 343, or 345. I, II; 1 hour, or 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 340. Mr. Scott and others.

342. Electronics. High vacuum electron tubes, emission, electron ballistics, tube characteristics, equivalent plate circuit, amplifiers. For students selecting the option in communication and electronics. Not open to students with credit in Electrical Engineering 340. I, II; 3 hours, or 0 to ¾ unit. Prerequisite: Electrical Engineering 320 and 321; credit or registration in Electrical Engineering 343, 350, and 351. Mr. Fett and others.

343. Electronics Laboratory. To accompany Electrical Engineering 342. Not open to students with credit in Electrical Engineering 341. I, II; 1 hour, or 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 342. Mr. Crothers and others.

344. Electronics. Continuation of Electrical Engineering 342. Modulation and detection, oscillators, gas filled tubes. Characteristics and applications. Not

open to students with credit in Electrical Engineering 212 or 340. I, II; 3 hours, or 0 to ¾ unit. Prerequisite: Electrical Engineering 342, 350, and 351; credit or registration in Electrical Engineering 345. Mr. Fett and others.

345. Electronics Laboratory. To accompany Electrical Engineering 344. Not open to students with credit in Electrical Engineering 213 or 341. I, II; 1 hour, or 0 to ¼ unit. Prerequisite: Electrical Engineering 342, 350, and 351; credit or registration in Electrical Engineering 344. Mr. Crothers and others.

350. Communication Networks and Lines. Four-terminal networks, reactance networks, general transmission line equations, low-loss lines, reflections, filters. I, II; 3 hours, or 0 to ¾ unit. Prerequisite: Electrical Engineering 320 and 321; credit or registration in Electrical Engineering 351. Mr. Barkson, Mr. Skroder, and others.

351. Communication Networks and Lines Laboratory. To accompany Electrical Engineering 350. I, II; 1 hour, or 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 350. Mr. Barkson, Mr. Skroder, and others.

352. Communication Engineering I. Fundamentals of coupled circuits, impedance transformation, reactance network synthesis as applied to radio frequencies; modulation and demodulation; radio frequency amplifiers and oscillators; principles of receivers and transmitters. I, II; 3 hours, or 0 to ¾ unit. Prerequisite: Electrical Engineering 342, 343, 350, and 351; credit or registration in Electrical Engineering 353. Mr. Jordan, Mr. Schwarzlose, and others.

353. Communication Engineering I Laboratory. To accompany Electrical Engineering 352. I, II; 1 hour, or 0 to ¼ unit. Prerequisite: Electrical Engineering 342, 343, 350, and 351; credit or registration in Electrical Engineering 352. Mr. Schwarzlose and others.

354. Communication Engineering II. Continuation of Electrical Engineering 352 with emphasis on very high frequencies and microwaves. Theory of VHF and microwave generators; electromagnetic fields, radiation and propagation of electromagnetic energy, radiating systems. I, II; 3 hours, or 0 to ¾ unit. Prerequisite: Electrical Engineering 352 and 353; credit or registration in Electrical Engineering 355. Mr. Jordan and others.

355. Communication Engineering II Laboratory. To accompany Electrical Engineering 354. I, II; 1 hour, or 0 to ¼ unit. Prerequisite: Electrical Engineering 352 and 353; credit or registration in Electrical Engineering 354. Mr. Albright and others.

360. Elements of Illuminating Engineering Design. Application of the fundamentals of optics and light to developments in the design of illumination equipment and lighting installations. I, II; 4 hours, or 0 to ½ unit. Prerequisite: Mathematics 132 and 142; Physics 104. Mr. Kraehenbuehl.

362. Principles of Illuminating Engineering. Concept and units in light calculations; calculation of illumination from point, line, and surface sources; interpretation of photometric and test data. I, II; 4 hours, or 0 to ¾ unit.

Prerequisite: Electrical Engineering 120; credit or registration in Electrical Engineering 363; Mathematics 345; Physics 270. Mr. Kraehenbuehl.

363. Illumination and Photometry Laboratory. Photometry and illumination measurements. I, II; 1 hour, or 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 362. Mr. Miller, Mr. Pierce.

364. Illumination Design and Economics. Design of lighting systems for natural and artificial illumination; applications for interiors and exteriors in both commercial and industrial installations; economic studies; design of reflectors and lighting equipment. II; 4 hours, or 0 to ¾ unit. Prerequisite: Electrical Engineering 362 and 363; credit or registration in Electrical Engineering 365. Mr. Horn.

365. Illumination Design Laboratory. To accompany Electrical Engineering 364. Checking and constructing equipment and installation designs in lighting. II; 1 hour, or 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 364. Mr. Horn.

366. Illumination Sources. Study of natural and artificial light sources covering combustion, incandescent, and gaseous lamps, with emphasis on fundamental laws; radiation measurements and colorimetry. II; 3 hours, or 0 to ½ unit. Prerequisite: Credit or registration in Electrical Engineering 364 and 365. Mr. Miller.

374. Electrical Energy Measurements System Protection. Transmission equipment, energy meters, protective relays. I, II; 3 hours, or 0 to ¾ unit. Prerequisite: Registration in Electrical Engineering 334, or consent of instructor. Mr. Faucett.

375. Energy Measurement and Protection Laboratory. To accompany Electrical Engineering 374. I, II; 1 hour, or 0 to ¼ unit. Prerequisite: Registration in Electrical Engineering 374. Mr. Faucett.

376. Power Circuit Analysis. Advanced analysis of circuits used for power transmission and distribution. I, II; 3 hours, or 0 to 1 unit. Prerequisite: Electrical Engineering 320 and 321. Mr. Knight.

378. Fundamentals of Power Transmission Engineering. Fundamentals of electrical and mechanical design of power transmission systems. I, II; 3 hours, or 0 to 1 unit. Prerequisite: Senior standing in electrical engineering. Mr. Faucett.

380. Illuminating Engineering. A second course in illumination, covering units, sources, point and surface illumination, design, and economics. I; 3 hours, or 0 to ½ unit. Prerequisite: Electrical Engineering 120; junior standing. Mr. Kraehenbuehl.

382. Principles of Electric Communication Engineering. Survey of electric communications, networks, infinite line, coupled circuits, R.F. amplifiers, inductive coordination. Not open to students with credit in Electrical Engineering 350, 351, 352, 353, 354, and 355. II; 3 hours, or 0 to ¾ unit. Prerequisite: Electrical Engineering 320, 321, 340, and 341; registration in Electrical Engineering 383. Mr. Skroder and others.

383. Principles of Electrical Communication Engineering Laboratory. To accompany Electrical Engineering 382. II; 1 hour, or 0 to ¼ unit. Prerequisite: Registration in Electrical Engineering 382. Mr. Skroder and others.

387. Electrical Design. Fundamental principles of electrical power apparatus design with particular application to transformers and generators. Properties of materials in common use; construction of coils; magnetic attraction; stored energy; field mapping; heat dissipation; temperature rise and rating of apparatus. For students selecting the option in power. I, II; 3 hours, or 0 to 1 unit. Prerequisite: Electrical Engineering 332 and 333; registration in Electrical Engineering 334 and 335. Mr. Archer and others.

389. Communication Design. Design, construction, and complete test of a radio transmitter or receiver. I, II; 3 hours, or 0 to 1 unit. Prerequisite: Electrical Engineering 352 and 353. Mr. Schwarzlose and others.

ENGLISH LANGUAGE AND LITERATURE

(Including Rhetoric)

The Department of English offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy. Students who enter graduate work with English as their major subject are required to give evidence of their ability to write good English. They must present the equivalent of fourteen hours of undergraduate work in English literature, the required college work in rhetoric, and the equivalent of four semesters of college work in Latin, or Greek, or French, or German. After the first year of graduate work a knowledge of French and German is indispensable.

Students making English their minor may be admitted to such courses as in the judgment of the instructor in charge they are qualified to pursue.

Degree of Master of Arts in English. In addition to complying with the general rules of the Graduate College, candidates for the degree of Master of Arts in English must comply with the following rules of the Department of English: (1) They must choose most of their work from the group of courses described as "for graduates," and (2) must pass a general examination.

This is a three-hour written examination based upon the knowledge of English and American literature which an undergraduate English major may be reasonably expected to have acquired. It must be taken during the student's first term of residence. All students failing to pass the examination during their respective first terms in residence are required to present a total of nine units for that degree, including one unit earned here in a survey course or in such other course as the Committee on Masters' Examinations may determine to be most needed. As a guide to the prospective students, it is suggested that the following undergraduate courses, or their equivalent, will best fit the pattern of the examination: (1) a reading course in ten plays of Shakespeare; (2) a course in one other major writer; (3) a course in a period of literature (e.g., the Renaissance, or the Romantic Period); (4) a survey of English literature.

Degree of Doctor of Philosophy in English. Candidates for the degree of Doctor of Philosophy in English may expect to be examined on the entire field

of the English language and literature. Candidates with literature as a major will take philology as a first minor. They are urged, furthermore, to acquaint themselves as fully as possible with the history and philosophy of the period in which their main interest lies, and with the foreign languages and literature most closely related to English and that period.

Degree of Master of Arts in the Teaching of English. Candidates for the degree of Master of Arts in the Teaching of English must earn four units in English, two units in education, and two units in electives. Requirements are English, 4 units (candidates for junior college teaching should take Rhetoric 345); Education 400, Philosophy of Education, or Education 302, History of American Education, 1 unit; and Education 409, Advanced Educational Psychology, 1 unit. The courses in English and the electives must be selected with the approval of the advisor. The electives may be in English, in education, or in exceptional cases, in other fields. The advisor for candidates for this degree is Dean Henning Larsen, 203 Lincoln Hall.

Graduate Teaching Faculty

Professors: P. N. Landis (Acting Head of Department), T. W. Baldwin, H. F. Fletcher, M. T. Herrick, H. Larsen, J. J. Parry, G. N. Ray, A. W. Secord, R. M. Smith.

Associate Professors: J. T. Flanagan, R. A. Gettmann, S. E. Glenn, M. S. Goldman, B. A. Milligan, C. W. Roberts, C. H. Shattuck, D. Smalley (Visiting).

Assistant Professors: G. B. Evans, A. G. Holaday, E. G. Mathews, R. W. Rogers, G. B. Stillwell, L. C. Warren.

Instructor: Cornelia P. Kelley.

ENGLISH LITERATURE

Courses for Graduates

401. Old English (Anglo-Saxon). An introduction to the language before 1000 A.D. I; 1 unit. Mr. Smith.

402. Old English (Beowulf). II; 1 unit. Prerequisite: English 401. Mr. Smith.

403. History of the English Language. A study of the development of the language from the earliest stages to the present time. I; 1 unit. Mr. Smith.

411. Chaucer and His Times. A study of Chaucer and his contemporaries. The chief aim of the course is an intimate acquaintance with Chaucer's poetry and an appreciation of his art. I; 1 unit. Mr. Smith.

412. Chaucer and His Times. Continuation of English 411. II; 1 unit. Mr. Smith.

415. Middle English. Introduction to middle English dialects with special emphasis on the East Midland. II; 1 unit. Offered in alternate years; not offered in 1949-1950. Mr. Smith.

417. English Literature from the Norman Conquest to 1400. Primarily literature written in Latin and French (read in translation). I; 1 unit. Mr. Parry.

418. English Literature from the Norman Conquest to 1400. A survey of the literature, in all languages, produced in England during the period. II; 1 unit. Mr. Parry.

420. Medieval Latin (Anglo-Latin Writers). Study of the English writers of the Middle Ages who wrote in Latin; reading of selections in the original. II; 1 unit. Prerequisite: A reading knowledge of classical Latin.

421. Literature of the Sixteenth Century. I; 1 unit. Mr. Baldwin.

422. Literature of the Sixteenth Century. Continuation of English 421. II; 1 unit. Mr. Baldwin.

425. Seminar in Spenser. A study of special problems relating to the works of Edmund Spenser, his background in England and in Ireland, and the second half of the sixteenth century. I; 1 unit. Prerequisite: English 326 or any course in the sixteenth century. Offered in 1949-1950 and in alternate years. Mr. Smith.

427. Development of Tudor Drama. I; 1 unit. Mr. Baldwin.

428. Development of Tudor Drama. Continuation of English 427. II; 1 unit. Mr. Baldwin.

431. Shakespeare and Elizabethan Drama. I; 1 unit. Mr. Baldwin.

432. Shakespeare and Elizabethan Drama. Continuation of English 431. II; 1 unit. Mr. Baldwin.

433. Seminar in Elizabethan Drama. II; 1 unit. Mr. Baldwin.

435. Literature of the Seventeenth Century. I; 1 unit. Mr. Fletcher.

436. Literature of the Seventeenth Century. Continuation of English 435. II; 1 unit. Mr. Fletcher.

441. Seminar in Milton and His Age. I; 1 unit. Prerequisite: English 435 and 436; second-year graduate standing. Mr. Fletcher.

442. Seminar in Milton and His Age. Continuation of English 441. II; 1 unit. Prerequisite: English 435 and 436; second-year graduate standing. Mr. Fletcher.

445. Literature of the Eighteenth Century. I; 1 unit. Mr. Secord.

446. Literature of the Eighteenth Century. Continuation of English 445. II; 1 unit. Mr. Secord.

451. Studies in the History of the Eighteenth Century Novel. I; 1 unit. Mr. Secord.

452. Studies in the History of the Eighteenth Century Novel. Continuation of English 451. II; 1 unit. Mr. Secord.

455. Seminar in the History and Theory of Prose Fiction. I; 1 unit. Mr. Gettmann.

456. Seminar in the History and Theory of Prose Fiction. Continuation of English 455. II; 1 unit. Mr. Gettmann.

459. The Romantic Movement. I; 1 unit. Mr. Gettmann.

460. The Romantic Movement. Continuation of English 459. II; 1 unit. Mr. Gettmann.

463. Studies in Victorian Literature. I; 1 unit. Mr. Ray.

464. Studies in Victorian Literature. Continuation of English 463. II; 1 unit. Mr. Ray.

491. Research in Special Topics (Thesis). Guidance in writing theses for advanced degrees. I; 1 to 2 units. Mr. Baldwin, Mr. Flanagan, Mr. Fletcher, Mr. Gettmann, Mr. Goldman, Mr. Herrick, Mr. Landis, Mr. Larsen, Mr. Mathews, Mr. Milligan, Mr. Parry, Mr. Roberts, Mr. Smith.

492. Research in Special Topics (Thesis). Guidance in writing theses for advanced degrees. II; 1 to 2 units. Mr. Baldwin, Mr. Flanagan, Mr. Fletcher, Mr. Gettmann, Mr. Goldman, Mr. Herrick, Mr. Landis, Mr. Larsen, Mr. Mathews, Mr. Milligan, Mr. Parry, Mr. Roberts, Mr. Smith.

Courses for Graduates and Advanced Undergraduates

311. Chaucer. I; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Stillwell.

313. Introduction to the Literature of the Middle Ages. The literature of western Europe from 1000 to 1500. The literary background and the literature of the castle. I; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Parry.

314. Introduction to the Literature of the Middle Ages. The literature of western Europe from 1000 to 1500. The literature of the cloister and the tavern. II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Parry.

325. English Literature from 1588 to 1660. II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Milligan.

326. Spenser. II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Goldman.

335. English Drama Previous to Shakespeare. From the beginning to 1600. II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing.

336. English Drama Exclusive of Shakespeare. From 1600 to 1700. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Herrick.

342. The Poetry of Milton. Origins, forms, artistic and ethical values; Milton's place in English literary history. II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Fletcher.

346. The Age of Dryden. I; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Evans.

347. Alexander Pope. Pope's prose and poetry together with selections from Pope's classical models (in translation). I; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Rogers.

351. The Mid-Victorian Novel. Thackery, Charlotte Brontë, Mrs. Gaskell, Dickens, George Eliot, Trollope. I; 3 hours, or ½ unit. Prerequisite: Junior standing.

355. Survey of English Literature. From the beginning to 1700. I; 3 hours, or ½ to 1 unit. Prerequisite: Senior standing. Mr. Holaday, Mr. Parry.

356. Survey of English Literature. From 1700 to 1900. II; 3 hours, or ½ to 1 unit. Prerequisite: Senior standing. Mr. Holaday, Mr. Parry.

360. Romanticism: The Artistic and Intellectual Characteristics of Eighteenth and Nineteenth Century Romantic Literature. A study of the literature of the eighteenth and early nineteenth centuries in terms of the romantic esthetics, ethics, politics, religious movements, interest in external nature, the literary "revivals," and romantic classicism. II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing.

363. Introduction to Comparative Literature. Same as German 363. A comparative study of great books in Greek, Roman, Italian, and Spanish literature. I; 3 hours, or ½ unit. Prerequisite: Junior standing. Mr. Goldman, Mr. Holaday, Mr. Landis, Mrs. Rapp, Mr. Van Horne, Mr. Warren.

364. Introduction to Comparative Literature. Same as German 364. A comparative study of great books in French, German, and English literature. II; 3 hours, or ½ unit. Prerequisite: Junior standing. Mr. Goldman, Mr. Holaday, Mr. Jacob, Mr. Landis, Mrs. Rapp, Mr. Rehder.

371. History and Principles of Literary and Rhetorical Criticism: Aristotle to Sidney. Same as Speech 371. I; 3 hours, or ½ to 1 unit. Prerequisite: Senior standing. Mr. Herrick.

372. History and Principles of Literary and Rhetorical Criticism: Sidney to the Present. Same as Speech 372. II; 3 hours, or ½ to 1 unit. Prerequisite: Senior standing. Mr. Herrick.

AMERICAN LITERATURE

Courses for Graduates

439. Problems in American Literature and Cultural History. A conference and research course devoted to intensive studies in the relation of selected writers and problems, in American literature, to critical movements and the cognate arts. I; 1 unit. Prerequisite: At least a survey of American literature, or consent of instructor. Mr. Flanagan.

440. Problems in American Literature and Cultural History. Continuation of English 439. II; 1 unit. Prerequisite: At least a survey of American literature, or consent of instructor. Mr. Flanagan.

491. Research in Special Topics. Guidance in writing theses for advanced degrees. I; 1 to 2 units. Mr. Flanagan, Mr. Glenn.

492. Research in Special Topics. Guidance in writing theses for advanced degrees. II; 1 to 2 units. Mr. Flanagan, Mr. Glenn.

Courses for Graduates and Advanced Undergraduates

315. The American Drama. An historical survey of the American drama from the beginning to Clyde Fitch, including the reading of a large number of representative plays, a study of technical developments, and a discussion of theaters and acting. I; 3 hours, or 1 unit. Prerequisite: Junior standing. Offered in 1948-1949 and in alternate years. Mr. Flanagan.

316. The American Drama. An historical survey of the American drama from Clyde Fitch to the present, including the reading of a large number of representative plays. II; 3 hours, or 1 unit. Prerequisite: Junior standing. Offered in 1948-1949 and in alternate years. Mr. Flanagan.

353. Studies in Middle Western Literature. A survey of Middle Western literature from about 1825 to Dreiser, with special emphasis on the development of realism in poetry and fiction. I; 3 hours, or 1 unit. Prerequisite: English 113 or 114, or one course in American history. Offered in 1949-1950 and in alternate years. Mr. Flanagan.

354. Studies in Middle Western Literature. A survey of Middle Western literature from Dreiser to Farrell, with special emphasis on the development of realism in poetry and fiction. II; 3 hours, or 1 unit. Prerequisite: English 113 or 114, or one course in American history. Offered in 1949-1950 and in alternate years. Mr. Flanagan.

375. Henry James and the Technique of Fiction. A study of the development of Henry James as a novelist, of the influence upon him, and of his influence on novelists of the twentieth century, chiefly American. I; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing; consent of instructor. Miss Kelley.

RHETORIC AND COMPOSITION

Courses for Graduates

491. Research in Special Topics (Thesis). Guidance in writing theses for advanced degrees. I; 1 unit. Mr. Roberts.

492. Research in Special Topics (Thesis). Guidance in writing theses for advanced degrees. II; 1 unit. Mr. Roberts.

Courses for Graduates and Advanced Undergraduates

345. The Theory and Practice of English Composition. An examination of modern prose style and a consideration of problems confronting writers and teachers of writing at the college level. I, II; 3 hours, or 1 unit. Prerequisite: Senior standing; consent of instructor. Mr. Roberts.

ENTOMOLOGY

The Department of Entomology offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy. The prerequisite for graduate work in entomology is two years of undergraduate biology, including zoology and entomology. A student who chooses entomology as a major for an advanced degree

must have had at least six hours of undergraduate courses in entomology. A reading knowledge of either French or German is required by the beginning of the second year. Minors may be elected in agronomy, bacteriology, botany, chemistry, horticulture, physiology, plant pathology, or zoology.

Fellowships

Two industrial research assistantships in entomology have been established by the Koppers Company, Inc., with a stipend of $1,200 each. They are provided for research in the development of new insecticides.

Graduate Teaching Faculty

Professors: W. P. Hayes (Head of Department), W. V. Balduf, G. C. Decker, G. S. Fraenkel, C. W. Kearns, H. H. Ross.

Assistant Professor: W. R. Horsfall.

Courses for Graduates

407. External Insect Anatomy. A comparative study of the external anatomy of various orders of insects. I; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Hayes.

408. Internal Insect Anatomy. A comparative study of the internal anatomy of various orders of insects. II; 1 unit. Prerequisite: Entomology 407. Offered in 1948-1949 and in alternate years. Mr. Hayes.

425. Seminar in Entomology. I; ¼ unit.

426. Seminar in Entomology. II; ¼ unit.

493. Research. Work may be taken in the following subjects: (a) morphology and embryology of insects, (b) economic entomology, (c) systematic entomology, (d) biology and ecology of insects, (e) insect physiology. I; ½ to 4 units. Mr. Balduf, Mr. Decker, Mr. Fraenkel, Mr. Hayes, Mr. Horsfall, Mr. Kearns, Mr. Ross.

494. Research. Work may be taken in the following subjects: (a) morphology and embryology of insects, (b) economic entomology, (c) systematic entomology, (d) biology and ecology of insects, (e) insect physiology. II; ½ to 4 units. Mr. Balduf, Mr. Decker, Mr. Fraenkel, Mr. Hayes, Mr. Horsfall, Mr. Kearns, Mr. Ross.

Courses for Graduates and Advanced Undergraduates

306. Special Problems. For students ready to take up some special investigation which may be completed as an undergraduate study or the beginning of a thesis problem for an advanced degree. It may also be used to prepare a thesis for scholastic honors. I, II; 2 to 5 hours, or ¼ to 1 unit. Prerequisite: Senior standing; any of the following: Entomology 107, 108, 131, 308, 309, 310, 313, 317, 318, 319, 320, 322, 323, 324, or Zoology 101 or 321. Mr. Balduf, Mr. Decker, Mr. Fraenkel, Mr. Hayes, Mr. Horsfall, Mr. Kearns, Mr. Ross.

308. Insect Pests of Field Crops. II; 3 hours, or ½ unit. Prerequisite: Entomology 101. Offered in 1948-1949 and in alternate years. Mr. Hayes.

309. Morphology and Taxonomy of Immature Insects. A study of the structures of nymphs, larvae, and pupae. This course is devoted to morphological studies which are followed by taxonomic studies in Entomology 310. I; 3 hours, or ½ unit. Prerequisite: Entomology 107, or equivalent; senior standing. Offered in 1949-1950 and in alternate years. Mr. Hayes.

310. Morphology and Taxonomy of Immature Insects. A study of the taxonomy of nymphs, larvae, and pupae. A sequence to Entomology 309. II; 3 hours, or ½ unit. Prerequisite: Entomology 309. Offered in 1949-1950 and in alternate years. Mr. Hayes.

312. Entomology for Teachers. Recognition of the chief orders of insects in their immature and adult stages, how they develop, life cycles, food, habitats, adaptations for feeding, oviposition, movement, protection, defense, making sound and other functions, interrelations with other organisms, environment, and social life. A collection of insects will be identified, mounted, and labeled. Field trips, laboratory, and discussions. S; 3 hours, or ½ unit. Prerequisite: One year of biology, botany, zoology, or equivalent. Offered in 1948 and every third year thereafter. Mr. Balduf.

313. Medical and Veterinary Entomology. Training in recognition, classification, methods of injury, habits, and control or destruction of insects, mites, and ticks which are predators, parasites, or disseminators of diseases among men and domestic animals. I; 4 or 5 hours, or ½ or 1 unit. Prerequisite: Entomology 101 and 102, or 103, or Zoology 320. Mr. Horsfall.

316. Advanced Economic Entomology. A consideration of the principles underlying ways and means of preventing injury to crops and various products. II; 3 hours, or ½ unit. Prerequisite: Entomology 101 or 103. Offered in 1948-1949 and in alternate years. Mr. Horsfall.

317. Classification of Insects. Orders with gradual metamorphosis, and principles of systematic entomology. The distinctive structural features of the orders comprising the Ametabola and Hetermetabola; comparison of various systems of classification of the orders; how to recognize the more common families; practice in keying to species. The principles embrace sources of material, segregation, and preparation of keys, descriptions, bibliographies, and outlines for revisional papers. I; 5 hours, or ½ unit. Prerequisite: Entomology 101 or 103, or equivalent; junior standing. Offered in 1948-1949 and in alternate years.

318. Classification of Insects. Orders with complete metamorphosis, and principles of systematic entomology. Distinctive structural features of the orders comprising the subclass Holometabola; comparison of the various systems of classification of the orders; how to recognize the more common families; practice in keying to species; literature; biographies. II; 5 hours, or 1 unit. Prerequisite: Entomology 101 or 103, or equivalent; junior standing. Offered in 1948-1949 and in alternate years.

319. Chemical Control of Insects. Discussion and actual practice in the most effective control measures for insect pests; training for professional or commercial work as an entomologist, pest control supervisor, or agricultural agent. I; 4 hours, or 1 unit. Prerequisite: Entomology 101 or 103; senior standing or a course in economic entomology. Mr. Kearns.

320. Chemistry and Toxicology of Insecticides. Designed to provide the fundamental information available concerning the mode of action, the relationship of chemical structure to toxicity, and the physiological explanation of the chemical poisoning of insects. II; 3 hours, or ½ unit. Prerequisite: One year of biology, or equivalent in animal sciences; a course in organic chemistry; senior standing.

322. Insect Bionomics. This phase of the biology of insects deals with life history and conditions of environment that favor abundance of insects representative of various habitats. II; 3 hours, or ½ unit. Prerequisite: Entomology 101 and 102, or 103, or Zoology 320; senior standing. Offered in 1949-1950 and in alternate years. Mr. Horsfall.

323. Insect Physiology. I; 5 hours, or 1 unit. Prerequisite: Entomology 108, or equivalent; a course in organic chemistry; senior standing.

324. Insect Physiology. II; 5 hours, or 1 unit. Prerequisite: Entomology 108, or equivalent; a course in organic chemistry; senior standing.

FOOD TECHNOLOGY

(Including Dairy Technology)

It is contemplated that programs leading to the degrees of Master of Science and Doctor of Philosophy will be developed in the newly established Department of Food Technology. At the present such programs are available only in Dairy Technology. As soon as possible, majors in the other principal fields (i.e., canning, freezing, dehydration, meat processing, beverages, baking, etc.) will be offered.

A student planning to take a major or minor in dairy technology should have had previous training as an undergraduate in this field. It is also desirable for the student to have had a course in statistics, advanced undergraduate training in mathematics and chemistry, and at least a year of French or German.

Minors may be selected from the following fields of study: economics, agricultural economics, business organization and operation, chemistry, bacteriology, physics, nutrition, veterinary medicine, and dairy production. Requirements for the minors will be established by the respective departments concerned.

To obtain a master's degree in dairy technology, a student must have credit in Chemistry 350, Dairy Technology 401 (1 unit), 404 (1 unit), and 493-494 (2 units). A course in statistics is also necessary unless such a course was taken by the student when an undergraduate. The remainder of the eight units required for the Master of Science degree can be taken in the major and minor fields.

Candidates for the degree of Doctor of Philosophy in Dairy Technology should complete the requirements for their minors by the end of the second year of residence so that the last year can be spent in research on their thesis problems (Dairy Technology 493 and 494). Each candidate will be required to pass a written examination at the end of the second year of residence but before the oral preliminary examination for the doctorate.

Second- and third-year graduate students are expected to attend all seminars (Dairy Technology 404) in dairy technology, but they can register for a maximum of only one unit of credit.

Graduate Teaching Faculty

Professors: L. B. Howard (Head of Department), E. O. Herreid, P. H. Tracy.

Associate Professors: S. L. Tuckey, R. M. Whitney.

DAIRY TECHNOLOGY

Courses for Graduates

401. Advanced Principles of Dairy Technology. Study of fundamental problems involved in the processing of milk and milk products. I; 1 unit. Prerequisite: Advanced standing in dairy technology. Mr. Herreid.

404. Seminar. Review of current literature in dairy technology. I, II; ½ unit. Prerequisite: Graduate standing in dairy technology.

491. Assigned Problems in Dairy Technology. Research on special problems for graduate students with a major interest in dairy technology. I; ½ to 2 units. Prerequisite: Graduate standing in dairy technology. Mr. Herreid, Mr. Tracy, Mr. Tuckey, Mr. Whitney.

492. Assigned Problems in Dairy Technology. Research on special problems for graduate students with a major interest in dairy technology. II; ½ to 2 units. Prerequisite: Graduate standing in dairy technology. Mr. Herreid, Mr. Tracy, Mr. Tuckey, Mr. Whitney.

493. Thesis. I; ½ to 4 units. Mr. Herreid, Mr. Tracy, Mr. Tuckey, Mr. Whitney.

494. Thesis. II; ½ to 4 units. Mr. Herreid, Mr. Tracy, Mr. Tuckey, Mr. Whitney.

Courses for Graduates and Advanced Undergraduates

301. Ice Cream Manufacture. Technical problems and methods involved in the manufacture of commercial ice cream, sherbets, and ices. I; 3 hours, or ½ unit. Prerequisite: Dairy Production 150 and 151; Dairy Technology 101. Mr. Tobias, Mr. Tracy.

302. Creamery Butter Manufacture. Preparation of cream, churning, and packaging of butter. II; 3 hours, or ½ unit. Prerequisite: Dairy Production 150 and 151; Dairy Technology 101. Mr. Tuckey.

303. Cheese Manufacture. Manufacture and ripening procedures for domestic and foreign types of cheese. I; 3 hours, or ½ unit. Prerequisite: Dairy Production 150 and 151; Dairy Technology 101. Mr. Tuckey.

304. Market Milk. Production, quality control, assembling, and processing of fluid milk and related products. II; 3 hours, or ½ unit. Prerequisite: Dairy Production 150 and 151; Dairy Technology 101. Mr. Herreid.

306. Condensed Milk and Milk Powder Manufacture. Methods of manufacturing different types of condensed and dried milks. II; 3 hours, or ½ unit. Prerequisite: Dairy Production 150 and 151; Dairy Technology 101. Mr. Tobias, Mr. Tracy.

308. Plant Management. Problems in the organization, financing, labor management, and operation of dairy plants. II; 3 hours, or ½ unit. Prerequisite: Senior standing in dairy technology. Mr. Tracy.

FRENCH

For a graduate degree in French, the student must have had at least three years of college work in French, including an advanced course in literature. Some knowledge of Latin, of other Romance languages, and of German is desirable.

Courses in the 300 group, for graduates and advanced undergraduates, normally offer only partial credit for graduate students.

Degree of Master of Arts in French. In addition to fulfilling the general requirements of the Graduate College, candidates for the degree of Master of Arts in French must pass an examination based on a general reading list. Candidates preparing to teach French will take French 409 and 410, unless they can demonstrate proficiency.

Degree of Doctor of Philosophy in French. Candidates for this degree are required to include French 475 and 476, for which some knowledge of Latin is essential.

Degree of Master of Arts in the Teaching of French. Candidates for the degree of Master of Arts in the Teaching of French must earn four units in French, two units in education, and two units in electives. Requirements are French 409-410, two units; Education 400, Philosophy of Education; or Education 302, History of American Education, one unit; and Education 409, Advanced Educational Psychology, one unit. The elective courses in French and the other electives must be selected with the approval of the advisor. The electives may be in French, in education, or, in exceptional cases, in other fields. The advisor for candidates for this degree is Professor J. F. Jackson, 230 Lincoln Hall.

Graduate Teaching Faculty

Professors: J. F. Jackson (Head of Department), J. E. Ehrhard (Visiting), R. Jasinski (Visiting), C. A. Knudson.

Assistant Professors: P. E. Jacob, J. R. Smiley.

Courses for Graduates

400. Beginning Course for Graduate Students. Basic grammar and vocabulary; reading practice. Designed for graduate students desiring help in preparing for the French reading requirements for the Ph.D. degree. I, II; 4 hours. No graduate credit.

401. Reading Course for Graduate Students. Grammar, vocabulary, general and special reading. Designed for graduate students desiring help in preparing for the French reading requirements for the Ph.D. degree. I, II; 4 hours. No graduate credit. Prerequisite: French 400, or French 101 and 102, or equivalent.

409. Phonetics and Advanced Syntax. An advanced theoretical and practical study of the sounds and syntax of present-day French, with some considera-

tion of stylistics. Conducted in French. I; 1 unit. Prerequisite: Graduate standing in French. Mr. Knudson.

410. Phonetics and Advanced Syntax. An advanced theoretical and practical study of the sounds and syntax of present-day French, with some consideration of stylistics. Conducted in French. II; 1 unit. Prerequisite: Graduate standing in French. Mr. Ehrhard, Mr. Knudson.

431. Old French Literature. Reading of characteristic selections from the eleventh to the fifteenth centuries, and study of the literary history of the period, with particular emphasis on epic and romance. I; 1 unit. Mr. Knudson.

432. Old French Literature. Reading of characteristic selections from the eleventh to the fifteenth centuries, and study of the literary history of the period, with particular emphasis on epic and romance. II; 1 unit. Mr. Knudson.

433. Villon, Rabelais, Montaigne, La Pléiade. I; 1 unit.

434. Villon, Rabelais, Montaigne, La Pléiade. II; 1 unit.

435. Seventeenth Century Literature. I; 1 unit. Mr. Jasinski.

436. Seventeenth Century Literature. II; 1 unit. Mr. Ehrhard.

437. Eighteenth Century Literature. I; 1 unit. Mr. Smiley.

438. Eighteenth Century Literature. II; 1 unit. Mr. Smiley.

447. Nineteenth Century Literature to 1850. I; 1 unit. Mr. Jackson.

448. Nineteenth Century Literature to 1850. II; 1 unit. Mr. Jackson.

453. French Realism and Naturalism. I; 1 unit. Mr. Jackson.

454. French Realism and Naturalism. II; 1 unit. Mr. Jackson.

465. La Littérature Contemporaine. In French. Poetry: Baudelaire. Symbolism up to Valéry. Prose writers from 1900 to 1940. I; 1 unit. Mr. Jacob.

466. La Littérature Contemporaine. In French. Poetry: Baudelaire. Symbolism up to Valéry. Prose writers from 1900 to 1940. II; 1 unit. Mr. Jacob.

475. History of the French Language. External history: development of the language in its historical setting. Internal history: the development of sounds, forms, vocabulary, and syntax from spoken Latin to modern French. I; 1 unit. Prerequisite: Graduate standing in French and an elementary knowledge of Latin. Offered in 1949-1950 and in alternate years. Mr. Knudson.

476. History of the French Language. External history: development of the language in its historical setting. Internal history: the development of sounds, forms, vocabulary, and syntax, from spoken Latin to modern French. II; 1 unit. Prerequisite: Graduate standing in French and an elementary knowledge of Latin. Offered in 1949-1950 and in alternate years. Mr. Knudson.

491. Research and Thesis. I; 1 to 4 units. Mr. Jackson, Mr. Jacob, Mr. Jasinski, Mr. Knudson, Mr. Smiley.

492. Research and Thesis. II; 1 to 4 units. Mr. Ehrhard, Mr. Jackson, Mr. Jacob, Mr. Knudson, Mr. Smiley.

Courses for Graduates and Advanced Undergraduates

309. Survey of French Literature. I; 3 hours, or ½ unit. Prerequisite: French 202, or equivalent, and junior standing; or senior standing and consent of instructor. Mr. Jackson.

310. Survey of French Literature. II; 3 hours, or ½ unit. Prerequisite: French 202, or equivalent, and junior standing; or senior standing and consent of instructor. Mr. Jackson.

317. Modern French Drama. I; 2 hours, or ½ unit. Prerequisite: French 202, or equivalent, and junior standing; or senior standing and consent of instructor. Mr. Viens.

318. Modern French Drama. II; 2 hours, or ½ unit. Prerequisite: French 202, or equivalent, and junior standing; or senior standing and consent of instructor. Mr. Viens.

323. French Drama of the Seventeenth and Eighteenth Centuries. I; 3 hours, or ½ unit. Prerequisite: French 202, or equivalent, and junior standing; or senior standing and consent of instructor. Mr. Jasinski.

324. French Drama of the Seventeenth and Eighteenth Centuries. II; 3 hours, or ½ unit. Prerequisite: French 202, or equivalent, and junior standing; or senior standing and consent of instructor. Mr. Ehrhard.

331. French Novel of the Nineteenth Century. From Balzac to Proust. I; 3 hours, or ½ unit. Prerequisite: Junior standing; French 201 and 202. Mr. Jacob.

332. French Novel of the Nineteenth Century. From Balzac to Proust. II; 3 hours, or ½ unit. Prerequisite: Junior standing; French 201 and 202. Mr. Jacob.

333. La Littérature Contemporaine. In French. Modern poetry from Baudelaire to Valéry. Prose writers from 1900 to 1940. I; 2 hours, or ½ unit. Prerequisite: Junior standing; French 201 and 202. Offered in 1949-1950 and in alternate years. Mr. Jacob.

334. La Littérature Contemporaine. In French. Modern poetry from Baudelaire to Valéry. Prose writers from 1900 to 1940. II; 2 hours, or ½ unit. Prerequisite: Junior standing; French 201 and 202. Offered in 1949-1950 and in alternate years. Mr. Jacob.

335. Civilisation Française. In French. I; 2 hours, or ½ unit. Prerequisite: French 202, or equivalent, and junior standing; or senior standing and consent of instructor. Offered in 1948-1949 and in alternate years. Mr. Jackson.

336. Civilisation Française. In French. II; 2 hours, or ½ unit. Prerequisite: French 202, or equivalent, and junior standing; or senior standing and consent of instructor. Offered in 1948-1949 and in alternate years. Mr. Jackson.

GENETICS

Those desiring a general training in genetics may take a major or minor in botany or zoology. Those desiring to approach agricultural problems through genetics may take a major or minor in agronomy, horticulture, animal science, or dairy production. For courses in the subject see departments of Agronomy, Animal

Science, Botany, Dairy Production, Horticulture, and Zoology. An interdepartmental genetics seminar is held at 4 p.m. on the second, third, and fourth Mondays, in 107 Animal Genetics Building.

GEOGRAPHY

The Department of Geography offers graduate work leading to the degree of Master of Science.

For graduate work in geography the student should have had at least the equivalent of an undergraduate major in geography. A major consists of twenty hours in geography, excluding Geography 101 and including Geography 371, and at least five hours of other courses not open to freshmen. Candidates for a master's degree should obtain from the department a copy of special regulations governing a preliminary examination for transfer students and a comprehensive examination near the close of the second semester of residence for all candidates.

Candidates for the degree of Master of Science in the Teaching of Geography must earn four units in geography, two of which are electives, two units in education, and two units in electives. Requirements are Geography 493 and/or 494, 1 unit; Geography 495 and/or 496, 1 unit; Education 400, Philosophy of Education, or Education 302, History of American Education, 1 unit; and Education 409, Advanced Educational Psychology, 1 unit. The elective courses in geography and the other electives must be selected with the approval of the advisor. Two electives must be in geography, and the other two in geography, in education, or, in exceptional cases, in other fields. The advisor for candidates for this degree is Professor J. H. Garland, 248 Natural History Building.

Graduate Teaching Faculty

Professors: J. A. Russell (Head of Department), W. O. Blanchard.

Associate Professors: J. L. Page, J. H. Garland.

Assistant Professor: A. W. Booth.

Courses for Graduates

493. Research. I; ½ to 2 units. Staff.

494. Research. II; ½ to 2 units. Staff.

495. Advanced Studies in Geography. Detailed investigation of selected problems or regions. Directed and supervised investigation designed to develop ability to conduct independent investigation. I; ½ to 2 units. Staff.

496. Advanced Studies in Geography. Detailed investigation of selected problems or regions. Directed and supervised investigation designed to develop ability to conduct independent investigation. II; ½ to 2 units. Staff.

Courses for Graduates and Advanced Undergraduates

313. Climates of the Continents. A regional treatment of the climates of the world by continents. I; 3 hours, or ½ unit. Prerequisite: Geography 101 and 111. Offered in 1949-1950 and in alternate years. Mr. Page.

342. Geography of Europe. Influence of climate, surface features, and natural resources on the distribution of the people, their industries, and routes of trade. New boundaries and present economic problems in their geographic setting. II; 3 hours, or ½ unit. Prerequisite: Eight hours of geography including Geography 103; junior standing. Mr. Blanchard.

351. Geography of Asia. A regional geography of Asia with concentration on the monsoon realm of southern and eastern Asia. I; 3 hours, or ½ unit. Prerequisite: Junior standing; 8 hours of geography. Offered in 1949-1950 and in alternate years. Mr. Booth.

361. Land Utilization. A geographical consideration of the nature of land utilization from the world, continental, and regional viewpoints. Special emphasis will be placed upon geographical techniques of land inventory, methods of land classification, and the detailed investigation of land utilization in this country and abroad. I; 3 hours, or ½ unit.

363. Production of Great World Staples. Geographic aspects of the mineral industries. I; 3 hours, or ½ unit. Prerequisite: Geography 103; junior standing. Offered in 1949-1950 and in alternate years. Mr. Blanchard.

365. Advanced Commercial Geography. Geographic factors influencing transportation by land, sea, and air. I; 3 hours, or ½ unit. Prerequisite: Geography 103 or 105; one regional course in geography; junior standing. Offered in 1948-1949 and in alternate years. Mr. Blanchard.

371. Introduction to Research. Limited to seniors and graduates whose major is geography, and to seniors whose major is in other departments and who have twelve hours of geography, including three hours in a regional course. I; 2 hours, or ½ unit. Staff.

372. Introduction to Research. Limited to seniors and graduates whose major is geography, and to seniors whose major is in other departments and who have twelve hours of geography, including three hours in a regional course. II; 2 hours, or ½ unit. Staff.

GEOLOGY

Graduate students may take work in geology leading to the degrees of Master of Science and Doctor of Philosophy. Candidates for the master's degree are advised to so plan their work that they secure a firm foundation in geology, rather than to specialize too narrowly. Candidates for the doctor's degree may work in the special fields of economic geology, geomorphology, mineralogy and petrography, paleontology and stratigraphy, and sedimentation.

For graduate work in geology a student must usually have had at least an undergraduate major in geology, including field training, and the requisite courses in chemistry, mathematics, and physics. A reading knowledge of French or German is desirable for the beginning graduate student and requisite for the advanced graduate student. An undergraduate major consists of twenty hours in geology selected from the following courses (or their equivalent): 102, Historical Geology; 131 and 132, Mineralogy; 301, Geomorphology; 311, Structural Geology; 315, Field Methods; 320, Invertebrate Paleontology; and 321, Stratigraphy. Graduate students in other departments may be admitted to graduate courses in

geology if they have had the prerequisites for the course desired, or by special permission in certain cases.

A candidate for the master's degree in geology must pass a general examination toward the close of the second semester of residence, covering the fields of geology listed in the courses named above and the graduate courses taken.

Graduate students whose undergraduate training has not included all of the "major" courses listed may take these courses, if listed as "Courses for Graduates and Advanced Undergraduates." More than the minimum of eight units for a master's degree will be required if it is necessary to include an undue number of such "300" courses.

A reasonable choice of a minor may be made by students working for the doctor's degree. Ordinarily the minor will be chemistry for those specializing in mineralogy and petrography; chemistry, physics, or mining engineering for economic geology; zoology or botany for paleontology; and agronomy (soils) or geography for geomorphology. Other minors may be chosen with departmental approval.

Fellowships

California Company Fellowship. A number of graduate fellowships in eastern and midwestern universities have been established by the California Company in fostering geological research. The stipend is $1,250 for the academic year.

Shell Fellowship. Established by the Shell Fellowship Committee to encourage graduate studies in the field of geology, leading to a master's or a doctor's degree. The stipend is $1,200 for a year's study plus $300 to cover material and equipment and other expenses related to the research project.

Graduate Teaching Faculty

Professors: G. W. White (Head of Department), C. A. Chapman, R. E. Grim, H. W. Scott, H. R. Wanless.

Associate Professors: A. F. Hagner, J. L. Hough, P. R. Shaffer.

Assistant Professor: B. Kummel.

Courses for Graduates

401. Advanced Dynamic Geology. A study of geologic processes and their effects. I; 1 unit. Prerequisite: Graduate standing in geology or in other departments allowing geology as a minor. Offered in 1949-1950 and in alternate years. Mr. Wanless.

402. Advanced Historical Geology. Principles of interpretation and problems of earth history. II; 1 unit. Prerequisite: Graduate standing in geology or in other departments allowing geology as a minor. Offered in 1949-1950 and in alternate years. Mr. Wanless.

403. History of Geology. II; ½ to 1 unit. Offered in 1948-1949 and in alternate years. Mr. White.

409. Sedimentation. I; 1 unit. Prerequisite: Graduate standing in geology or related sciences. Mr. Wanless.

422. Stratigraphic Geology: Paleozoic. I; 1 unit. Prerequisite: Geology 321. Mr. Scott.

423. Stratigraphic Geology: Mesozoic and Cenozoic. II; 1 unit. Prerequisite: Geology 321. Mr. Kummel.

425. Micropaleontology: Foraminifera. Classification of microfossils, foraminifera; stratigraphic correlation. I; 1 unit. Prerequisite: Geology 320 or Zoology 320. Mr. Scott.

426. Micropaleontology: Ostracoda. Classification of microfossils, ostracodes, conodonts, scolecodonts, and other major groups; stratigraphic correlations. II; 1 unit. Prerequisite: Geology 320 or Zoology 320. Mr. Scott.

435. Igneous Petrology. The origin and history of igneous rocks. Application of chemistry and physics to igneous petrology. In the laboratory a study is made of selected rock suites, and special methods of petrographical investigation are covered. I; 1 unit. Mr. Chapman.

436. Metamorphic Petrology. Problems in metamorphism and advanced studies of metamorphic rocks. In the laboratory, selected rock suites are studied and special methods of investigation are covered. II; 1 unit. Mr. Chapman.

437. Sedimentary Petrology. II; 1 unit. Prerequisite: Graduate standing in geology or related fields such as agronomy. Mr. Hough.

440. Mineragraphy. Microscopic study of ore minerals including methods of identification, textures, structures, and paragenesis. I; 1 unit. Mr. Hagner.

441. Seminar in Mineral Deposition. Critical study of processes and theories of mineral deposition. Laboratory examination of illustrative ore suites, and survey of the literature. II; 1 unit. Mr. Hagner.

446. Petroleum Geology: Principles. I; 1 unit. Prerequisite: Graduate standing in geology. Offered in 1949-1950 and in alternate years. Mr. Hough.

447. Petroleum Geology: Fields. A continuation of Geology 446. II; 1 unit. Prerequisite: Graduate standing in geology. Offered in 1949-1950 and in alternate years. Mr. Hough.

450. Geology for Civil Engineers. Advanced physical geology, with emphasis on the geological aspects of civil engineering. I; 1 unit. Prerequisite: Geology 150, or equivalent; graduate standing in civil engineering. Mr. Hough.

491. Research (Thesis). Individual work under supervision of members of the staff in their respective fields. I; ½ to 4 units.

492. Research (Thesis). Individual work under supervision of members of the staff in their respective fields. II; ½ to 4 units.

493. Advanced Studies in Geology. Supervised individual study. I; ½ to 2 units.

494. Advanced Studies in Geology. Supervised individual study. II; ½ to 2 units.

Courses for Graduates and Advanced Undergraduates

301. Geomorphology. The study of the history, origin, and characteristics of land forms produced by fluvial, glacial, wind, and wave erosion, or by a combination of these, acting upon the major kinds of geologic materials and structures. I, II; 4 hours, or 1 unit. Prerequisite: Geology 102; junior standing. Mr. White.

311. Structural Geology. Rock deformation and its results. Lectures, laboratory, and field trip. I, II; 4 hours, or 1 unit. Prerequisite: Geology 102; junior standing. Mrs. Boos.

315. Field Methods. Lecture, quiz, and field trips. Mapping of an area in southern Illinois. Credit will be given only on completion of a satisfactory written report. II; 3 hours, or ½ unit. Prerequisite: Geology 102; junior standing. Mr. Hough.

316. Geology of the Baraboo, Wisconsin, Region. A field course covering structural, stratigraphic, glacial, and physiographic features. The emphasis is on methods of study and interpretation. A comprehensive report is required. An elective for departmental major or specialization. Field trip scheduled for June 12 to 19, 1949; estimated travel expense about $40. First meeting 7:00 p.m., June 3, 1949. S; 3 hours, or ½ unit. Prerequisite: Geology 101 or 150, and 102; consent of instructor. Mr. Hough.

319. Geology of Illinois. I; 3 hours, or ½ unit. Prerequisite: Geology 102; junior standing. Offered in 1948-1949 and in alternate years. Mr. Wanless.

320. Invertebrate Paleontology. Fossil groups in biological sequence. Lectures and laboratory. I, II; 4 hours, or 1 unit. Prerequisite: Geology 102; junior standing. Mr. Kummel.

321. Stratigraphy. General stratigraphy, fossil faunas, with special reference to invertebrates, and correlation. Emphasis is placed on the physical history. I, II; 4 hours, or 1 unit. Prerequisite: Geology 320. Mr. Scott.

325. Paleobotany. Same as Botany 325. The structure, phylogeny, and geological distribution of representative fossil plants. Two or three field trips. II; 3 or 5 hours, or ½ or 1 unit. Prerequisite: Botany 100 and 101, or 104, or Division of General Studies 131 and 132 and Geology 101, or consent of instructor. Offered in 1948-1949 and in alternate years. Mr. Stewart.

335. Optical Mineralogy. Study of the optical properties of minerals and the use of the petrographic microscope. Emphasis is placed on the identification of minerals by the immersion method. Designed for students in geology, ceramics, chemistry, mining, and agriculture. I; 4 hours, or 1 unit. Prerequisite: Geology 132; junior standing. Mr. Chapman.

336. Petrography. Study of the constituents, composition, textures, structures, and classification of rocks. In the laboratory, rocks are studied in hand specimen and thin section. Emphasis is placed on the ordinary methods of petrographical investigation. II; 4 hours, or 1 unit. Prerequisite: Geology 335; junior standing. Mr. Chapman.

340. Mineral Deposits. Principles of mineral deposition, occurrence, structure, and genesis of mineral deposits. I; 4 hours, or 1 unit. Prerequisite: Geology 311, 335, 336, or consent of instructor; senior standing. Mr. Hagner.

341. Mineral Deposits. Study of principal types of mineral deposits making use of the literature. Laboratory examination of suites from important mining districts. II; 4 hours, or 1 unit. Prerequisite: Geology 340; senior standing. Mr. Hagner.

351. Geophysics of Mining. Same as Mining Engineering 351. Principles of geophysics and their application to mining processes. I; 3 hours, or 1 unit.

Prerequisite: Senior standing in engineering or geology, or consent of instructor. Mr. Chedsey.

GERMAN

The Department of German offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy.

Students electing German as a major should have completed a four-year course of undergraduate study in German corresponding to the four-year course at this University. They should be familiar with the principal works of the writers of the classical and modern periods of German literature, possess a general knowledge in the history of German letters and civilization, and be able to follow lectures in the German language. Acquaintance with German history, philosophy, and art in their relation to the general European background is highly desirable. A reading knowledge of French is important and is required for advanced graduate work. Likewise some fluency in Latin is seriously recommended.

Fields of concentration for advanced degrees include German philology and linguistics, medieval literature, and modern literature. Such studies are greatly facilitated by an excellent library collection which is particularly strong in German literature from the seventeenth to the twentieth century. Special collections include the following items: the German folksong collection (including the Vaticana), the John Meier collection, the Moritz Heyne collection in German philology, the Armin Rattermann collection in German-Americana, the Bab-Feldman collection in modern German drama, and many others.

Candidates for the degree of Master of Arts in the Teaching of German must earn four units in German, two units in education, and two units in electives. Requirements are German, 2 to 2½ units to be chosen from the following courses: German 301, 302, 311, 312, 315, 320, 331, or 332; 1½ to 2 units from German courses open only to graduates; Education 400, Philosophy of Education, or Education 302, History of American Education, 1 unit; and Education 409, Advanced Educational Psychology, 1 unit. The electives must be selected with the approval of the advisor. The electives may be in German, in education, or, in exceptional cases, in other fields. The advisor for candidates for this degree is Professor Mimi I. Jehle, 217 Lincoln Hall.

Fellowships

Information concerning scholarships and fellowships may be obtained from the office of the Graduate College. Students desiring graduate assistantships or information on graduate course requirements and suggested readings should apply directly to the Department of German.

Graduate Teaching Faculty

Professors: H. Rehder (Head of Department), J. T. Geissendoerfer.
Associate Professors: J. R. Frey, E. A. Philippson.
Assistant Professors: Mimi I. Jehle, H. Penzl, H. Stegemeier.

Courses for Graduates

400. Beginning German for Graduate Students. Introduction into the reading of German texts in the sciences and the humanities. Designed for graduate students desiring help in preparing for the German reading requirements for the Ph.D. degree. I, II; 4 hours. No graduate credit.

401. Seminar. Seminar in methods of literary criticism. I, II; ½ to 1 unit. Mr. Rehder.

416. History of the German Language. II; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Philippson.

426. Gothic. An introduction to Germanic (comparative) linguistics. II; 1 unit. Offered in 1949-1950 and in alternate years. Mr. Penzl.

431. German Literature of the Middle Ages. German literature from 800 to 1400. I; 1 unit. Offered in 1949-1950 and in alternate years. Mr. Philippson.

432. German Literature from 1400 to 1700. Renaissance, Reformation, and baroque in German literature. Lectures and readings. II; 1 unit. Offered in 1949-1950 and in alternate years. Mr. Rehder.

445. Old High German. Grammar and interpretation of the oldest literary documents. I or II; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Philippson.

450. Readings in German for Graduate Students. Designed for graduate students desiring help in preparing for the German reading requirements for the Ph.D. degree. I, II; 3 hours. No graduate credit. Prerequisite: German 400.

451. German Romanticism. Early romanticism. II; 1 unit. Offered in 1949-1950 and in alternate years. Mr. Geissendoerfer.

458. Intellectual Backgrounds of German Literature. Social and philosophical currents reflected in German literature (eighteenth to twentieth century). II; 1 unit. Prerequisite: German 301 and 302, or equivalent. Offered in 1948-1949 and in alternate years. Mr. Rehder.

460. Seminar in German Literature. Advanced research work in German literature; discussion of problems and papers. II; 1 unit. Prerequisite: German 301 and 302; three to four units in literature courses for advanced undergraduates and graduates. Mr. Rehder.

491. Thesis. I; ½ to 4 units. Mr. Rehder.

492. Thesis. II; ½ to 4 units. Mr. Rehder.

493. Research in Special Topics. I; ½ to 4 units. Staff.

494. Research in Special Topics. II; ½ to 4 units. Staff.

495. Bibliography and Methods of Literary History. To be taken concurrently with German 401. I; ½ unit. Mr. Frey.

Courses for Graduates and Advanced Undergraduates

301. German Literature to the Eighteenth Century. I; 3 hours, or 1 unit. Prerequisite: Three years of college German, or equivalent. Mr. Frey.

302. German Literature Since the Eighteenth Century. II; 3 hours, or 1 unit. Prerequisite: Three years of college German, or equivalent. Mr. Frey.

311. Goethe. Introduction to Goethe's life and works. I; 2 or 3 hours, or 1 unit. Prerequisite: Three years of college German. Offered in 1948-1949 and in alternate years. Mr. Geissendoerfer.

312. Goethe's *Faust*. Intensive study of Goethe's *Faust*, Parts I and II. II; 2 or 3 hours, or 1 unit. Prerequisite: Three years of college German, or equivalent. Offered in 1948-1949 and in alternate years. Mr. Geissendoerfer.

315. Middle High German. I; 3 hours, or 1 unit. Prerequisite: Three years of college German, or equivalent. Offered in 1949-1950 and in alternate years. Mr. Penzl.

320. History of German Civilization. A selected topical, historical, and pictorial analysis of German culture and civilization. S; 3 hours, or 1 unit. Prerequisite: Three years of college German, or equivalent. Offered in 1949-1950 and in alternate years. Mr. Stegemeier.

331. German Classics I. Study of the works of Lessing, Herder, and Wieland. I; 2 or 3 hours, or 1 unit. Prerequisite: Three years of college German, or equivalent. Offered in 1949-1950 and in alternate years. Mr. Geissendoerfer.

332. German Classics II. Study of the works of Schiller, Kleist, Hölderlin, and Jean Paul. II; 2 or 3 hours, or 1 unit. Prerequisite: Three years of college German, or equivalent. Offered in 1949-1950 and in alternate years. Mr. Geissendoerfer.

363. Introduction to Comparative Literature. Same as English 363. A comparative study of great books in Greek, Roman, Italian, and Spanish literature. I; 3 hours, or ½ unit. Prerequisite: Junior standing. Mr. Goldman, Mr. Holaday, Mr. Landis, Mr. Van Horne, Mr. Warren.

364. Introduction to Comparative Literature. Same as English 364. A comparative study of the great books in French, German, and English literature. II; 3 hours, or ½ unit. Prerequisite: Junior standing. Mr. Goldman, Mr. Holaday, Mr. Jacob, Mr. Landis, Mr. Rehder.

HISTORY

The Department of History offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy. Graduate work in history presupposes two years of college work in this subject, or sixteen semester hours, which should include courses in European and American history equivalent to History 111, 112, 151, and 152. Linguistic preparation, especially in French and German, is important. For ancient and medieval history some knowledge of Latin is essential. Spanish is useful for certain fields of American and Latin-American history.

Graduate courses in history at the University of Illinois are of three kinds: (1) lecture courses providing information, interpretation, and guidance in general reading; (2) instruction in methodology, historiography, and bibliography (History 495 is required of all graduate students in history during their first year); (3) seminars for the study of special fields with a view to training in methods of historical criticism and research and in the writing and presentation of historical essays.

The following statement regarding the specific requirements for higher degrees in history conforms to the general requirements of the Graduate College.

Degree of Master of Arts in History. Shortly after his registration each candidate for this degree is required to take a comprehensive examination based on his undergraduate work in history. Questions are given in the following four fields of history: ancient, medieval and modern European, English, and American. Candidates must answer questions in three out of four fields. Each candidate must have a reading knowledge of one foreign language, ordinarily French or German, as demonstrated by an oral examination administered by the department. Each candidate is expected to devote special attention to two of the following fields: ancient history, medieval history of continental Europe, modern history of continental Europe, English history, American history, Latin-American history, and the history of the Far East. Each candidate is also expected to write a master's thesis in one of the fields of his specialization. By special permission he may substitute a third field for the thesis requirement. To constitute a field of specialization a minimum of two units of graduate study is ordinarily required.

Graduate study in history may also be pursued in connection with the degrees of Master of Arts in the Social Sciences (see page 218), and Master of Arts in the Teaching of Social Studies (see page 218).

Degree of Doctor of Philosophy in History. The candidate who selects history as his major subject should prepare himself for a preliminary examination in five fields, of which four are normally in history and one is in an outside related subject.

The preparation of the candidate should include a minimum of four units in the field of history in which he wishes to specialize and in which his thesis is to be written. This field constitutes his major.

There should be a minimum of three units in a second field known as the first minor, and two units each in three other fields. One of these, outside the department, constitutes the second minor.

The Department of History offers the following fields of specialization and preparation: ancient history, medieval history, continental Europe from 1300 to 1648 (Renaissance and Reformation), continental Europe and its dependencies since 1648, England and its dependencies, the United States, and Latin America. This enumeration of fields is not to be regarded as excluding the possibility of accepting others as may be determined by the department in individual cases.

The second minor field may be selected from the following departments and areas, although other suitable second minors may be arranged through consultation with department advisors:

Political Science. (1) International law and diplomacy, (2) modern government, (3) municipal government, (4) constitutional and administrative law and jurisprudence, (5) political theory.

Economics and Sociology. (1) Economic history, (2) economic theory, (3) public and private finance, (4) social reform, (5) principles of sociology.

Philosophy and Education. (1) History of ancient and medieval philosophy, (2) history of modern philosophy, (3) history of education.

Literature. Some division of the history of literature, which may be either comparative literature of a limited period or the literature of a particular country for a more extended period as may be agreed upon in each case.

Graduate students have an opportunity to pursue research in connection with the Illinois Historical Survey, an organization carrying on systematic studies in the history of the Midwest. Through the use of materials collected by this survey, graduate students in the department are provided with opportunities of useful training in the study of manuscript as well as printed materials.

Doctoral candidates interested in specializing in American culture may elect a major in American history with a first minor (three-unit field) in American literature, and the second minor (two-unit field) in the history of fine arts in the United States.

Fellowships

The department awards annually to the ranking student in English or medieval history the Laurence M. Larson Memorial Fellowship, which represents the income from a fund of $5,000 set up in the will of Lillian D. Larson in memory of her husband, at one time head of the Department of History.

The department participates with the Department of Political Science in the Kendric C. Babcock Fellowship established under the will of Dean Kendric C. Babcock. For the third year these appointments carry a stipend of $1,000, and post-doctoral grants carry a stipend of $2,400. Nominations for these fellowships are made by the heads of the departments of History and Political Science. Application forms may be obtained from the Graduate College Office.

Graduate Teaching Faculty

Professors: F. C. Dietz (Acting Head of Department), P. V. B. Jones, J. G. Randall, F. S. Rodkey, F. A. Shannon, R. P. Stearns, J. W. Swain.

Associate Professors: A. E. Bestor, Jr., E. L. Erickson, C. E. Nowell, C. G. Starr, Jr., R. C. Werner.

Assistant Professors: Louise B. Dunbar, A. R. Hogue, Mary L. Shay, J. B. Sirich.

Associate: Natalia M. Belting.

Courses for Graduates

401. Seminar in Medieval History. An introduction to medieval historians. I; 1 unit.

402. Seminar in Medieval History. Medieval struggles for world unity. II; 1 unit.

405. Renaissance Studies. I; 1 unit. Mr. Jones.

406. Renaissance Studies. II; 1 unit. Mr. Jones.

409. Seminar in Modern History: The Enlightenment. I; 1 unit. Prerequisite: Reading knowledge of one major European language other than English. Mr. Stearns.

410. Seminar in Modern History: The Enlightenment. Variation of the topics treated in History 409 as student interest and ability (or previous work) necessitates. II; 1 unit. Prerequisite: Reading knowledge of one major European language other than English. Mr. Stearns.

419. Seminar in the History of Europe with Emphasis on Russia, 1815 to 1848. I; 1 unit. Mr. Rodkey.

420. Seminar in the History of Europe with Emphasis on Russia, 1848 to 1870. II; 1 unit. Mr. Rodkey.

431. Seminar in English History. I; 1 unit. Mr. Dietz.

432. Seminar in English History. II; 1 unit. Mr. Dietz.

452. Seminar in American History. Introduction to research. I; 1 unit. Mr. Randall.

453. Problems in the Social History of the United States Before 1860. A seminar in the social and economic history of the United States before 1860. Students will work on individual problems related to a general topic and will give oral and written accounts in class of the progress and results of their research. I; 1 unit. Mr. Shannon.

454. Problems in the Social History of the United States Since 1860. A seminar in the social and economic history of the United States after 1860. Students will work on individual problems related to a general topic and will give oral and written accounts in class of the progress and results of their research. II; 1 unit. Mr. Shannon.

455. The Westward Movement, 1749 to 1755. I or II; 1 unit.

456. The Westward Movement, 1755 to 1761. I or II; 1 unit. Offered in 1949-1950 and in alternate years.

457. The Westward Movement, 1761 to 1763. I or II; 1 unit.

471. Seminar in the Intellectual History of the United States, 1789 to 1860. I; 1 unit. Prerequisite: Admission to candidacy for the master's degree in history. Mr. Bestor.

472. Seminar in the Intellectual History of the United States, 1860 to 1948. II; 1 unit. Prerequisite: Admission to candidacy for the master's degree in history. Mr. Bestor.

475. Seminar in Latin American History: The A.B.C. Powers and Mexico. I; 1 unit. Mr. Nowell.

476. Seminar in Latin American History: The Revolutionary Period. Studies in the history of Latin America during the first half of the nineteenth century; emphasizes research in special topics. II; 1 unit. Mr. Nowell.

481. Introduction to the Ancient Historians. Seminar in ancient history. II; 1 unit. Prerequisite: Some linguistic training in ancient languages. Mr. Swain.

482. Seminar in Ancient History. I; 1 unit. Mr. Swain.

491. Research in Special Topics. Individual direction in research and guidance in writing theses for advanced degrees. I; 1 to 4 units. Mr. Bestor, Mr. Dietz, Miss Dunbar, Mr. Jones, Mr. Nowell, Mr. Randall, Mr. Rodkey, Mr. Shannon, Mr. Starr, Mr. Stearns, Mr. Swain, Mr. Werner.

492. Research in Special Topics. Individual direction in research and guidance in writing theses for advanced degrees. II; 1 to 4 units. Mr. Bestor, Mr.

Dietz, Miss Dunbar, Mr. Jones, Mr. Nowell, Mr. Randall, Mr. Rodkey, Mr. Shannon, Mr. Starr, Mr. Stearns, Mr. Swain, Mr. Werner.

495. Historical Method. Required of all candidates for an advanced degree in history who do not present evidence of similar training elsewhere. I; 1 unit. Mr. Randall.

Courses for Graduates and Advanced Undergraduates

301. The Middle Ages, 400 to 1100 A.D. Europe from the fall of Rome to the first crusade. I; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Mr. Hogue.

302. The Middle Ages, 1100 to 1500 A.D. Europe from the rise of towns to the establishment of national monarchy. II; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Mr. Hogue.

304. Medieval Civilization. Religious and intellectual. II; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history or political science; junior standing. Mr. Hogue.

305. The Age of the Renaissance. I; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history. Mr. Jones.

306. The Age of the Protestant and Catholic Reformation, 1500 to 1648. II; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Mr. Jones.

309. Development of Modern Europe: Absolutism and Colonial Expansion, 1648 to 1789. I; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Mr. Sirich.

310. Development of Modern Europe: Revolution and Reaction, 1789 to 1848. II; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Mr. Sirich.

313. European History, 1900 to 1918. I; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history, political science, or economics; junior standing. Mr. Hogue.

314. European History, 1918 to 1948. II; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history or political science; junior standing. Mr. Hogue.

317. History of Modern Italy, 1700 to 1830. I; 2 hours, or ½ unit. Prerequisite: One year of college history; junior standing. Miss Shay.

318. History of Modern Italy, 1831 to 1948. II; 2 hours, or ½ unit. Prerequisite: One year of college history or political science; junior standing. Miss Shay.

319. Tsarist Russia: Its Background, Institutions, and Problems to 1825. A survey of what is basic in the cultural heritage of the Russian people and the Russian state up to the revolutionary era. I; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Mr. Rodkey.

320. Modern Russia and Its Problems, 1825 to the Present. An analysis of the various currents and factors that have accounted for what is now

dominant in the culture and organization of the Soviet Union. II; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Mr. Rodkey.

322. History of Spain and Portugal. A survey of the Iberian Peninsula from the earliest times until the present. I; 3 hours, or ½ to 1 unit. Prerequisite: One course in history; junior standing. Mr. Nowell.

323. Science, Philosophy, and the Modern European Mind. Intellectual history of modern Europe, 1543 to 1770. I; 3 hours, or ½ to 1 unit. Prerequisite: Senior standing, or junior standing and one of the following: History 111 and 112, 131 and 132, Division of General Studies 121 and 122, English 111 and 112, or Philosophy 101. Mr. Sirich, Mr. Stearns.

324. Science, Idealism, and Materialism. Intellectual history of modern Europe, 1770 to 1914. II; 3 hours, or ½ to 1 unit. Prerequisite: History 323, or consent of instructor; junior standing. Mr. Sirich.

333. The History of England from 1377 to 1485. I; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Offered in 1949-1950 and in alternate years. Mr. Dietz.

334. The History of England under the Tudors, 1485 to 1603. II; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Offered in 1949-1950 and in alternate years. Mr. Dietz.

335. Foundations of English and American Democratic Institutions, 1603 to 1642. I; 2 hours, or ½ unit. Prerequisite: One year of college history or political science; junior standing. Mr. Stearns.

336. Foundations of English and American Democratic Institutions, 1642 to 1714. II; 2 hours, or ½ unit. Prerequisite: One year of college history or political science; junior standing. Mr. Stearns.

339. History of the British Commonwealth in the Nineteenth and Twentieth Centuries, 1783 to 1870. I; 2 hours, or ½ unit. Prerequisite: One year of college history, preferably History 131 and 132, though 111 and 112 and 151 and 152 satisfy the requirement; junior standing. Mr. Erickson.

340. History of the British Commonwealth in the Nineteenth and Twentieth Centuries, 1870 to the Present. II; 2 hours, or ½ unit. Prerequisite: One year of college history, preferably History 131 and 132, though 111 and 112 and 151 and 152 satisfy the requirement; junior standing. Mr. Erickson.

343. Social and Economic History of England Since the Beginning of the Industrial Revolution. Social and economic history of England, 1750 to 1848. I; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Offered in 1948-1949 and in alternate years. Mr. Dietz.

344. Social and Economic History of England Since the Beginning of the Industrial Revolution. Social and economic history of England from 1848 to 1948. II; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Offered in 1948-1949 and in alternate years. Mr. Dietz.

345. Constitutional History of England to 1485. I; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history or political science; junior standing. Mr. Dietz.

346. Constitutional History of England from 1485 to the Present. II; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history or political science; junior standing. Mr. Dietz.

351. American Colonies in the Seventeenth Century. I; 3 hours, or ½ to 1 unit. Mr. Werner.

353. Foundations of American Nationality: The Colonies in the Eighteenth Century to 1763. I; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Miss Dunbar.

354. Foundations of American Society: The Transition to National Life and Organization, 1763 to 1789. II; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Miss Dunbar.

357. Social and Economic History of the United States, 1775 to 1860. The growth of American economic life and institutions from the Revolution to the outbreak of the Civil War. I; 3 hours, or ½ to 1 unit. Prerequisite: History 152; junior standing. Mr. Shannon.

358. Social and Economic History of the United States Since 1860. The growth of American economic life and institutions since 1860. II; 3 hours, or ½ to 1 unit. Prerequisite: History 152; junior standing. Mr. Shannon.

359. The Civil War and Reconstruction. Remote and immediate causes of the Civil War, especially from 1850 to 1861; problems of the North and South during the war; the consequences of the war; the efforts to create a new Union, 1865 to 1877, and the new problems created by those efforts. I; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Mr. Shannon.

361. History of the United States, 1877 to 1917. I; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Randall.

363. History of the West, 1634 to 1774. I; 2 hours, or ½ unit. Prerequisite: One year of college history; junior standing. Miss Belting.

364. History of the West, 1774 to 1830. II; 2 hours, or ½ unit. Prerequisite: One year of college history; junior standing. Miss Belting.

365. History of Illinois from 1809 to the Present. Evolution of a typical middle western commonwealth. I; 2 hours, or ½ unit. Prerequisite: One year of college history.

366. The South: Old and New. I; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Randall.

369. Political and Constitutional Development of the United States to 1809. I; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history or political science; junior standing. Mr. Randall.

370. Political and Constitutional Development of the United States Since 1809. II; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history or political science; junior standing. Mr. Randall.

371. American Intellectual and Cultural History to 1877. The contribution of social and political thought, religion, science, scholarship, and education to the history of American civilization. I; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing.

372. American Intellectual and Cultural History Since 1877. The contribution of social and political thought, religion, science, scholarship, and education to the history of American civilization. II; 3 hours, or ½ to 1 unit. Prerequisite: History 371; junior standing.

375. History of Latin America to 1824. A survey of Latin American history from the discovery of America until 1824. I; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Mr. Nowell.

376. Latin America Since 1824. A history of the Latin American republics from their independence to the present. II; 3 hours, or ½ to 1 unit. Prerequisite: One course in college history; junior standing. Mr. Nowell.

377. History of the A.B.C. Powers. History of Argentina, Brazil, and Chile from their origins to the present. I; 3 hours, or ½ unit. Prerequisite: One course in history; junior standing. Offered in 1948-1949 and in alternate years. Mr. Nowell.

378. History of the Caribbean Area. A survey of the Caribbean, Mexico, and Central America from the discovery of America to the present. I, II; 3 hours, or ½ unit. Prerequisite: One course in history; junior standing. Offered in 1949-1950 and in alternate years. Mr. Nowell.

381. Ancient Greek States. History of the Greek States from the earliest times to 334 B.C. I; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Mr. Swain.

382. Ancient Imperialism. Alexander and his successors. II; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Mr. Swain.

383. The Roman Republic. History of the Roman Republic to 44 B.C. I; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Mr. Swain.

384. Ancient Imperialism. The Roman Empire. II; 3 hours, or ½ to 1 unit. Prerequisite: One year of college history; junior standing. Mr. Swain.

391. History of Eastern Asia to 1839. History of eastern Asia (China, Japan, and Korea) to 1839. I; 2 hours, or ½ unit. Prerequisite: One year of college history; junior standing. Mr. Werner.

392. History of Eastern Asia Since 1839. History of eastern Asia (China, Japan, and Korea) since 1839. II; 2 hours, or ½ unit. Prerequisite: One year of college history; junior standing. Mr. Werner.

HOME ECONOMICS

Students preparing to make home economics their major subject for a master's degree should complete the undergraduate curriculum in home economics, or should have equivalent training. The degree is designated as Master of Science or

Master of Arts in Home Economics, depending upon the baccalaureate degree. The major work may be done in one of five curricula: (1) general home economics, (2) foods and nutrition, (3) housing and household management, (4) child development and family relations, or (5) textiles and clothing. The degree of Master of Science in Home Economics Education is granted to those students who take their major work in the field of home economics education.

Candidates for a master's degree in home economics with the major work in general home economics, housing and household management, or child development and family relations, are required to take some advanced courses in education, economics, psychology, or sociology.

Candidates for a master's degree with the major work in foods and nutrition should comply with the requirements of that field of concentration as provided in the undergraduate curriculum, or should have had equivalent training. These candidates are required to take Chemistry 350, Biochemistry, or Chemistry 240 and 241, Physical Chemistry, in addition to graduate courses in home economics. At least four units of work must be in home economics and two of these units in home economics courses numbered above 400.

Graduate students who choose home economics as their minor for the degree of Doctor of Philosophy must have adequate preparation in home economics, and must complete three units for a first minor or two units for a second minor, in addition to credit offered for the master's degree. At least one unit must be taken in courses numbered above 400.

Candidates for the degree of Master of Science in Home Economics Education must earn eight units as follows: home economics, 2 to 2½ units; education, 3½ to 4 units; electives, 2 units. The requirements are (1) 2 to 2½ units of home economics chosen from courses in home management (Home Economics 361, 378, 379, 472), foods and nutrition (Home Economics 320, 322, 330, 331), textiles and clothing (Home Economics 380, 386, 388, 389, 395), child development and family relationships (Home Economics 301, 378, 379, 410, 472); (2) Education 409, Advanced Educational Psychology, 1 unit; (3) Education 400, Philosophy of Education, or Education 302, History of American Education, 1 unit; (4) Education 453, Seminar in Home Economics Education, 1 unit; (5) Education 452, Curriculum Problems and Trends in Home Economics Education, 1 unit, or Home Economics 377, Home Economics Extension (Adult Education), ½ unit. The elective courses must be selected with the approval of the advisor, Professor Letitia Walsh, 202 Gregory Hall.

Graduate Teaching Faculty

Professors: Kathryn V. Burns (Acting Head of Department), D. G. Carter, Nellie L. Perkins, Janice M. Smith.

Associate Professors: Harriet T. Barto, Doris J. Brockway, Pearl Z. Janssen, Florence M. King, E. Evelyn Smith.

Assistant Professors: Margaret R. Goodyear, Beula V. McKey, Frances O. Van Duyne.

Courses for Graduates

410. Problems in Familiy Living. Family relationships and their significance to the growth of every family member. I or II; 1 unit. Prerequisite: Sociology 220. Miss Perkins.

420. Seminar in Nutrition. I; ½ unit. Miss J. Smith.

423. Problems in Human Nutrition. Methods of assessing nutritional status of humans. II; ½ to 1 unit. Prerequisite: Home Economics 324, or equivalent desirable. Miss J. Smith.

481. Seminar.

(a) Foods. Study and discussion of recent research. I; ½ unit. Prerequisite: Undergraduate curriculum with major in foods and nutrition (or undergraduate majors in chemistry and bacteriology or physiology if certain undergraduate courses in foods and nutrition were included). Miss Van Duyne.

(b) Child Development. Advanced problems. I; 1 unit. Prerequisite: Home Economics 301. Miss Perkins.

482. Seminar.

(a) Foods. Study and discussion of recent research. II; ½ unit. Prerequisite: Undergraduate curriculum with major in foods and nutrition (or undergraduate majors in chemistry and bacteriology or physiology if certain undergraduate courses in foods and nutrition were included). Miss Van Duyne.

(b) Child Development. Advanced problems. II; 1 unit. Prerequisite: Home Economics 301. Miss Perkins.

493. Research. Work may be taken in the following subjects: (a) nutrition, (b) foods, (c) household management, (d) textiles and clothing. I; ½ to 3 units. Miss King, Miss Perkins, Miss J. Smith, Miss Van Duyne.

494. Research. Work may be taken in the following subjects: (a) nutrition, (b) foods, (c) household management, (d) textiles and clothing. II; ½ to 3 units. Miss King, Miss Perkins, Miss J. Smith, Miss Van Duyne.

Courses for Graduates and Advanced Undergraduates

301. Advanced Problems in Home Guidance of Children. Emphasis is placed upon the functions and relations of routine and creative activities and the interplay of personalities in the total behavior patterns with a view to helping students understand the less obvious and more subtle aspects of child development, and to differentiate between desirable and undesirable guidance procedures practiced by adult members of the family. II; 3 hours, or ½ unit. Prerequisite: Home Economics 201 and 202; consent of instructor. Miss Perkins.

305. Human Heredity. Heredity in man and its relation to various individual and social problems. I; 3 hours, or ½ unit. Graduate credit does not count towards a major in genetics.

320. Diet in Disease. I, II; 3 hours, or ½ unit. Prerequisite: Home Economics 220. Miss Barto.

321. Foods and Nutrition. Recent developments in chemistry, digestion, and metabolism of nutrients. S; 3 hours, or ½ unit. Prerequisite: Home Economics 220; senior standing. Offered in 1949-1950 and in alternate years. Miss J. Smith.

322. Physical Growth and Nutrition. Lecture, readings, and discussions. I; 2 hours, or ½ unit. Prerequisite: Home Economics 220; senior standing; consent of instructor. Miss J. Smith.

324. Problems in Nutrition. Discussions and investigations. II; 3 to 5 hours, or ½ to 1 unit. Prerequisite: Home Economics 220; Chemistry 350; senior standing. Miss McKey, Miss J. Smith.

328. Readings in Food and Nutrition. Reports, discussions, and review of scientific literature. I; 1 hour, or ¼ unit. Prerequisite: Home Economics 220; senior standing; credit or registration in one of the following: Chemistry 350, Home Economics 320, 322, 324, 330, or 331. Miss Barto, Miss Van Duyne.

329. Readings in Food and Nutrition. Reports, discussions, and review of scientific literature. II; 1 hour, or ¼ unit. Prerequisite: Home Economics 220; senior standing; credit or registration in one of the following: Chemistry 350; Home Economics 320, 322, 324, 330, or 331. Miss Barto, Miss Van Duyne.

330. Experimental Foods. A consideration of the manner in which such variables as ingredients, proportions, and techniques in food preparation affect the quality of the product. I, II; 3 hours, or ½ unit. Prerequisite: Home Economics 232; Bacteriology 104. Mrs. Janssen.

331. Problems in Foods. Applications of chemical and physical principles to advanced food problems. II; 3 hours, or ½ unit. Prerequisite: Home Economics 330. Miss Van Duyne.

345. Institution Management. Purchase of food supplies and equipment for institutions; grades of food, judging of quality and cost in relation to season, pure food laws, and government inspection; the storeroom and its management; equipment and furnishing; institution housekeeping, floor plans and routing; specifications for equipment; inventory of equipment; visits to stores and markets. I, II; 3 hours, or ½ unit. Prerequisite: Credit or registration in Home Economics 240 and Economics 108; consent of instructor. Miss E. Smith.

350. Institution Dietaries and Administration. Dietary studies and menu making for various types of institutions, such as dormitories, cafeterias, hospitals, and tearooms; problems of organization, personnel studies, administration of food service, records and cost accountings, professional ethics. Opportunity will be given for observation and practice in various fields. Field trip is required: approximate cost, $40. II; 4 hours, or ½ to 1 unit. Prerequisite: Home Economics 220 and 240; consent of instructor. Miss E. Smith.

355. Advanced Quantity Cookery and Catering. Planned for students in the restaurant management curriculum and for other qualified students. Practice in menu making and aspects of management necessary for special catering functions and meal projects. Special lectures and demonstrations emphasizing the artistry of preparation, serving, and merchandising of quality food. Supervised practice in various food service units. Field trips and special assignments. II; 3 hours, or ½ unit. Prerequisite: Home Economics 350; consent of instructor. Miss E. Smith.

361. Farm Home Planning in Relation to Function. Same as Agricultural Engineering 361. A study of farmhouse conditions, needs, and functions; basic principles and their application to planning, remodeling, and building; financial and management factors; federal, state, and private housing programs. Lectures, discussions, and problems. II; 2 hours, or ½ unit. Prerequisite: Home Economics 272, or consent of instructor. Mr. Carter.

377. Home Economics Extension. History and development; types of county organizations; objectives; extension teaching tools; county program determinations and evaluation. Field trips. II; 3 hours, or ½ unit. Prerequisite: Senior standing in home economics; consent of instructor. Mrs. Burns.

378. Problems in Home Management. Individual investigation and reports of specific problems in the field of home management. I; 3 hours, or ½ unit. Prerequisite: Home Economics 272; consent of instructor. Miss Goodyear, Miss Perkins.

379. Problems in Home Management. Individual investigation and reports of specific problems in the field of home management. II; 3 hours, or ½ unit. Prerequisite: Home Economics 272; consent of instructor. Miss Goodyear, Miss Perkins.

380. Textiles. Textiles from the economic, artistic, physical, and chemical viewpoints. I; 3 hours, or ½ unit. Prerequisite: Home Economics 180; Chemistry 132; Economics 108; senior standing; consent of instructor. Miss King.

386. Clothing Design and Construction. Problems in creating original designs, developing a more thorough understanding of the figure through design adaptation. Emphasis on adaptability to fabric draping or flat pattern construction. Investigation of sources of inspiration and relationship to significant trends in design. II; 4 hours, or 1 unit. Prerequisite: Home Economics 286 and 285; senior standing. Miss Brockway.

388. Problems in Textiles and Clothing. Investigation and report of specific problems in the field of textiles and clothing. I; 3 hours, or ½ unit. Prerequisite: Home Economics 286 or 380; senior standing; consent of instructor. Each student will undertake an individual problem which in some cases may involve prerequisites in chemistry and physics. Miss Brockway, Miss King.

389. Problems in Textiles and Clothing. Investigation and report of specific problems in the field of textiles and clothing. II; 3 hours, or ½ unit. Prerequisite: Home Economics 286 or 380; senior standing; consent of instructor. Each student will undertake an individual problem which in some cases may involve prerequisites in chemistry and physics. Miss Brockway, Miss King.

395. Fashion Analysis. Factors affecting design, production, distribution, promotion, and trends in fashion development; forecasting methods of measurement and prediction; price levels — relation to fashion cycle and quality in design and workmanship. II; 3 hours, or ½ unit. Prerequisite: Consent of instructor. Miss Brockway.

HORTICULTURE

Graduate work is offered in the Department of Horticulture leading to the Master of Science and Doctor of Philosophy degrees. Candidates may specialize for either degree in floriculture, plant pathology, pomology, or vegetable crops.

Twenty hours of undergraduate work in horticulture and allied subjects are required of students who choose horticulture as a major, and twelve hours are required of those who select it as a minor. The department will waive certain of these requirements for some fields of major study if the student has had an equivalent preparation in the fundamental sciences. It is desirable, when the major field of study is decided upon during the junior or senior year, to select the fundamental science courses accordingly and, if possible, to include in the undergraduate preparation the elementary courses in German or French.

Advanced work in botany, chemistry, entomology, agronomy, genetics, or agricultural economics may be taken advantageously with horticulture to make a well-balanced course of graduate study.

Graduate Teaching Faculty

Professors: B. L. Wade (Head of Department), H. W. Anderson, A. S. Colby, W. A. Huelsen, N. E. Stevens.

Associate Professors: J. R. Kamp, V. W. Kelley, R. V. Lott, J. P. McCollum, H. H. Thornberry, F. F. Weinard.

Assistant Professors: C. J. Birkeland, D. Gottlieb, M. B. Linn, R. L. McMunn, D. Powell, J. Skok.

Courses for Graduates

404. Plant Virology. Same as Botany 404 and Plant Pathology 404. Fundamental concepts; classification, symptomology; infectivity; biological, chemical, and physical properties; techniques for transmission, staining, assay, filtration, and purification; control methods; sources of information; history of virology. II; 1 unit. Prerequisite: Consent of instructor. Offered in 1949-1950 and in alternate years. Mr. Thornberry.

417. Discussions in Plant Pathology. Same as Botany 417 and Plant Pathology 417. Required for majors in plant pathology and as elective for graduate students in plant science. I, II; ¼ unit. Mr. Anderson, Mr. Stevens.

447. Vegetable Crops Seminar. Discussion of current literature pertaining to problems of vegetable crops. I; ¼ unit. Mr. Huelsen, Mr. McCollum, Mr. Skok.

448. Vegetable Crops Seminar. Discussion of current literature pertaining to problems of vegetable crops. II; ¼ unit. Mr. Huelsen, Mr. McCollum, Mr. Skok.

461. Pomology Seminar. Discussion of current research and literature in pomology and allied fields. I; ¼ unit. Prerequisite: Graduate standing in horticulture or allied fields. Mr. Colby, Mr. Lott, Mr. McMunn.

462. Pomology Seminar. Discussion of current research and literature in pomology and allied fields. II; ¼ unit. Prerequisite: Graduate standing in horticulture or allied fields. Mr. Colby, Mr. Lott, Mr. McMunn.

464. Advanced Small Fruit Culture. Detailed studies of varietal classification, growth, and fruiting habits, and the effects of cultural practices on production. The results of recent research with small fruits both in the station experimental plots and elsewhere are used as a basis for the work. II; ½ to 1 unit. Prerequisite: Graduate standing in horticulture. Mr. Colby.

466. Fruit Development and Senescence. The anatomy, histology, and physiology of development, maturation, and ripening in fruits and nuts. Discussions and laboratory. Critical analysis of research literature, study and practice of pertinent techniques. Designed as preparation for thesis and other research in this field. II; 1 unit. Prerequisite: Botany 345; Chemistry 132, 133, or 234; consent of instructor. Offered in 1949-1950 and in alternate years. Mr. Lott.

491. Thesis. Research on the thesis problem in (a) floriculture, (b) fruit breeding, (c) plant pathology, (d) pomology, and (e) vegetable crops. I; ½ to 4 units. Prerequisite: Twenty hours undergraduate work in horticulture and allied subjects for a major and twelve hours for a minor. Required of horticulture majors.

492. Thesis. Research on the thesis problem in (a) floriculture, (b) fruit breeding, (c) plant pathology, (d) pomology, and (e) vegetable crops. II; ½ to 4 units. Prerequisite: Twenty hours undergraduate work in horticulture and allied subjects for a major and twelve hours for a minor. Required of horticulture majors.

493. Research. Research on problems in (a) floriculture, (b) fruit breeding, (c) plant pathology, (d) pomology, and (e) vegetable crops. I; ½ to 4 units. Prerequisite: Twenty hours undergraduate work in horticulture and allied subjects for a major and twelve hours for a minor. Required in major or minor in horticulture.

494. Research. Research on problems in (a) floriculture, (b) fruit breeding, (c) plant pathology, (d) pomology, and (e) vegetable crops. II; ½ to 4 units. Prerequisite: Twenty hours undergraduate work in horticulture and allied subjects for a major and twelve hours for a minor. Required in major or minor in horticulture.

Courses for Graduates and Advanced Undergraduates

307. Fruit Diseases. Same as Botany 307 and Plant Pathology 307. Symptomatology; laboratory and field studies of representative diseases; control measures. I; 3 hours, or ½ unit. Prerequisite: Botany 317 or 372. Offered in 1949-1950 and in alternate years. Mr. Anderson.

308. Vegetable Diseases. Same as Botany 308 and Plant Pathology 308. Symptomatology; laboratory and field studies of representative diseases; control measures. II; 3 hours, or ½ unit. Prerequisite: Botany 317 or 372. Offered in 1948-1949 and in alternate years. Mr. Linn.

317. Plant Pathology. Same as Botany 317 and Plant Pathology 317. Causes, diagnosis, and treatment of plant diseases. I; 3 hours, or ½ unit. Prerequisite: Junior standing; 1 year of plant science including either Botany 100 and 101, or 104, or 105. Mr. Stevens.

321. Floricultural Physiology. Plant hormones, effect of light, temperature, humidity, and gases on growth of ornamental plants; principles of disease and insect control. Lectures, assigned readings, discussion. I; 3 hours, or ½ unit. Prerequisite: Botany 130; junior standing. Mr. Weinard.

322. Plant Nutrition. Soil conditions in relation to the growth of ornamental plants; soil and plant tissue tests, fertilizers and their use; soilless culture; water supplies and automatic watering. Lectures, assigned readings, discussions. II; 3 hours, or ½ unit. Prerequisite: Botany 130; Agronomy 201; junior standing. Mr. Weinard.

333. Marketing Horticultural Products. Same as Agricultural Economics 333 and Marketing 333. Producing and consuming areas; transportation; refrigeration, agencies, functions, and channels of distribution; cooperatives; marketing costs and factors affecting prices; standardization, grading, and inspection; marketing news service; perishable agricultural commodity act and other regulations; attempts to control surpluses; canning and other processing; foreign trade, consumer preference and expansion of domestic markets. I; 3 hours, or ½ unit. Prerequisite: Agricultural Economics 130, Marketing 101, or 12 hours of horticulture. Mr. Kelly.

343. Structure and Classification of Vegetable Crop Plants. Principles of classification and structure of vegetable crop plants with special reference to their use and production. I; 3 hours, or ½ unit. Prerequisite: Botany 100 and 101, or 105; junior standing. Offered in 1948-1949 and in alternate years. Mr. Skok.

345. Growth and Development of Vegetable Crops. Factors affecting growth, development, and quality of vegetable crops. Discussions. I; 4 hours, or 1 unit. Prerequisite: Botany 130, or consent of instructor; senior standing. Offered in 1949-1950 and in alternate years. Mr. McCollum.

361. Current Horticultural Literature. Assigned topics; review of books, technical journals, and other publications. I; 1 hour, or ¼ unit. Prerequisite: Junior standing. Mr. Skok.

362. Current Horticultural Literature. Assigned topics; review of books, technical journals, and other publications. II; 1 hour, or ¼ unit. Prerequisite: Junior standing. Mr. Skok.

379. Research Methods in Plant Pathology. Same as Botany 379 and Plant Pathology 379. Lectures and laboratory on the techniques for identification of plant diseases and their causal agents; for evaluation of plant protectants; for the study of the physiology of parasitism, and methods for planning research projects, evaluating data, and preparation of manuscripts for publication. I; 3 hours, or ½ unit. Prerequisite: Botany 317; senior standing. Offered in 1949-1950 and in alternate years. Mr. Gerdemann, Mr. Gottlieb, Mr. Thornberry.

382. Improvement of Horticultural Crops by Breeding. Mechanism of hereditary variations and varietal differentiation in horticultural plants as a basis for determining the method of approach to crop improvement problems, with emphasis on asexually propagated crops. II; 3 hours, or ½ unit. Prerequisite: Junior standing; one year of horticulture, or equivalent, ex-

clusive of Horticulture 142 and 161. Offered in 1949-1950 and in alternate years. Mr. Birkeland.

HUMANITIES

The Division of the Humanities is composed of the Departments of Classics, English, French, German, History, Philosophy, Spanish and Italian, and Speech. It sponsors several courses of interdepartmental interest and purpose, serving the Liberal Arts and Sciences requirement in general education. Its teaching faculty consists of the full-time faculties of the departments listed, of the rank of instructor and above. Professor Helmut Rehder is chairman of the Division.

Courses for Graduates and Advanced Undergraduates

301. Introduction to Linguistics. Introduction to the science of language. I; 3 hours, or 1 unit. Mr. Kahane.

JOURNALISM

Graduate work in journalism is offered in the following fields: (1) editorial and (2) advertising. The program of graduate study in journalism is limited at the present time to the Master of Science degree.

Admission to the graduate program in journalism (either editorial or advertising) is based on the following: (1) Completion of the requirements for a bachelor's degree in an institution of recognized standing, with a major in journalism, English, or the social sciences. A major normally consists of twenty semester credits. (2) Satisfactory grades in undergraduate work (at least half of grades should be B or above). Students who do not have the required grades in undergraduate studies are admitted in individual cases on "special status."

Requirements for the degree of Master of Science in Journalism include the following:

(1) A major consisting of four units in journalism, or three units in journalism and one additional unit approved by the candidate's graduate advisor and the Dean of the Graduate College, including:

(a) For editorial majors, at least two units from the following: Journalism 431, Seminar in Editorial Problems and Policies I; Journalism 432, Seminar in Editorial Problems and Policies II; Journalism 471, Introduction to Communications; and Journalism 474, Government and Mass Communications. In addition, candidates in this field must have completed the following courses or their equivalent at either the undergraduate or graduate level: Journalism 311, Newspaper Law; Journalism 321 and 322, Copyreading; Journalism 323, Advanced Reporting.

(b) For advertising majors, at least two units from the following: Journalism 471, Introduction to Communications; Journalism 481, Advanced Advertising Principles; and Journalism 482, Research Methods in Advertising. In addition, candidates in this field must have completed the following courses or their equivalent at either the undergraduate or graduate level: Journalism 281, Principles of Advertising; Journalism 382, Advertising Copy and Layout; Journalism 384, Advertising Campaigns.

(2) A minor of at least two units in a subject other than journalism.

(a) For editorial majors, the recommended fields are economics, English, history, philosophy, political science, psychology, and sociology.

(b) For advertising students, the recommended fields are business organization and operation including marketing, economics, home economics, psychology, and sociology.

(3) A minimum total of eight units.

Candidates whose primary interest is in research in any field of journalism should register for Journalism 491 and 492, Research in Special Topics.

Fellowships

The International Circulation Managers' Association awards annually two fellowships of $750 each to graduates in journalism who intend to continue their education. Information concerning the fellowships may be obtained from H. Phelps Gates, *Christian Science Monitor,* Boston, head of the association's committee which makes the awards.

Graduate Teaching Faculty

Professors: F. S. Siebert (Director of the School of Journalism), R. R. Barlow, L. W. Murphy, R. B. Nixon (Visiting), C. H. Sandage, W. Schramm.

Associate Professors: L. W. McClure, A. Rae, J. F. Wright.

Assistant Professors: D. E. Brown, M. D. Seil, J. T. Trebilcock, N. Wedding.

Instructors: V. Fryburger, T. B. Peterson.

Courses for Graduates

431. Seminar in Editorial Policies and Problems I. Journalism as a social institution; policies and problems of the press studied in relation to the changing economic, political, and social environment; the reciprocal influence of public opinion and mass communication agencies; comparison of democratic and nondemocratic systems; present trends and tendencies. I; 1 unit. Prerequisite: Graduate standing in journalism.

432. Seminar in Editorial Policies and Problems II. The literature of journalism: a critical survey of books and periodicals dealing with the problems and policies of the press; representative foreign publications compared with those of the United States; methods of compiling special bibliographies; the presentation of research. II; 1 unit. Prerequisite: Graduate standing in journalism.

441. Measurement of Opinion and Attitude. Same as Psychology 441. Theory and practice in measurement of opinion and attitude formation and change. Attitude scales; factors affecting morals; interpretation of results from social and psychological characteristics of the population; intensity of attitudes; relations among attitudes and opinions. I or II; 1 unit. Prerequisite: Psychology 100; a course in statistics; a course in sociology, social psychology, advertising, or market research. Mr. Harrell.

471. Introduction to Communications. Principal methods for studying content,

style, audience, control factors, economic basis, and social effect of mass communications — readings, discussion, and practice in using some of the methods. I; 1 unit. Mr. Schramm.

474. Government and Mass Communications. Legal, constitutional, and administrative problems of media of mass communications; restrictive, facilitating, and supplementary functions of government as related to mass media. II; 1 unit. Mr. Siebert.

481. Advanced Advertising Principles. Same as Marketing 481. Emphasis is placed on determination and understanding of the principles as related to the science, philosophy, and art of advertising. I; 1 unit. Mr. Sandage.

482. Research Methods in Advertising. Same as Marketing 482. A critical study of research methods and their applications to the solution of advertising problems. II; 1 unit. Mr. Sandage.

491. Research in Special Topics (Thesis). I; 1 to 2 units. Prerequisite: Graduate standing in journalism. Mr. Sandage, Mr. Schramm, Mr. Siebert.

492. Research in Special Topics (Thesis). II; 1 to 2 units. Prerequisite: Graduate standing in journalism. Mr. Sandage, Mr. Schramm, Mr. Siebert.

Courses for Graduates and Advanced Undergraduates

308. High School Journalism. Journalistic writing in the high school; newspaper study and training of newspaper readers; supervision of school publications and publicity; junior college courses in journalism. I, II; 3 hours, or ½ unit. Prerequisite: Education 109; junior standing. Mr. Brown.

309. Public Relations. Publicity methods and public relations; representation of business and other sponsors to the public and representation of the public to employers. Preparation of public relations units for the press and other media. I; 2 hours, or ½ unit. Prerequisite: Senior standing in journalism, or consent of instructor. Mr. Murphy.

310. Press Systems of the World. Press of England, France, Germany, Italy, Russia, Latin America, China, and Japan; international organization of the press. II; 2 hours, or ½ unit. Prerequisite: Junior standing. Mr. Barlow.

311. Newspaper Law. Freedom of the press; the right to gather, publish, and comment on the news. I; 3 hours, or ½ unit. Prerequisite: Junior standing. Mr. Siebert.

320. Editorial Studies and Writing. Writing of editorials and preparation of editorial judgments. Policies for editorials and for the editorial page. I; 3 hours, or ½ unit. Prerequisite: Journalism 212; senior standing in journalism. Mr. Barlow.

321. Copyreading I. Newspaper desk work; editing the news; correction of faulty news stories. Some attention to head-writing, news pictures, and page makeup. I, II; 3 hours, or ½ unit. Prerequisite: Credit or registration in Journalism 204; Journalism 212. Mr. Rae.

322. Copyreading II. Handling wire copy; makeup and design of newspaper pages. I, II; 3 hours, or ½ unit. Prerequisite: Journalism 321. Mr. Rae.

323. Advanced Reporting. Advanced types of news investigation and treatment.

I, II; 3 hours, or ½ unit. Prerequisite: Journalism 211 and 212, or equivalent. Mr. Trebilcock.

328. Trade and Technical Magazines. Preparation of fact articles for trade journals, technical journals, house organs, and class publications. Especially recommended for students whose major is agriculture, home economics, engineering, and other scientific fields. I, II; 3 hours, or ½ unit. Prerequisite: Junior standing. Mr. Peterson.

343. Newspaper Circulation Problems. Study of the promotion, sales, distribution, and administration problems of the circulation departments of weekly and daily newspapers. I; 3 hours, or ½ unit. Prerequisite: Journalism 241. Mr. Rae.

365. Radio News. News writing and editing for broadcasting; radio news style; preparation and practice for special event reporting; commentaries and interpretations; radio news services, and processing radio news service copy. I, II; 3 hours, or ½ unit. Prerequisite: Journalism 211 and 212. Mr. Brown.

368. Radio Law. Federal legislation, with emphasis on the Communications Act of 1934 and the regulations of the Federal Communications Commission, legal problems in program operations, censorship and editorial selections, copyright, and author-producer relations. II; 2 hours, or ½ unit. Prerequisite: Junior standing. Mr. Siebert.

382. Advertising Copy and Layout. Same as Marketing 382. Theory and practice of advertising copy writing and layout for newspaper, magazine, and direct mail; advertising planning for the local advertiser; use of consumer and market surveys, copy-testing methods, and advertising readership studies. I, II; 4 hours, or ½ unit. Prerequisite: Journalism 281, or Marketing 381. Mr. Seil.

383. Advertising Media. Same as Marketing 383. Analysis of the various advertising media in terms of markets served and factors to consider in the selection of media. I, II; 2 hours, or ½ unit. Prerequisite: Journalism 281, or Marketing 381. Mr. Fryburger.

384. Advertising Campaigns. Same as Marketing 384. Planning and execution of an advertising campaign; market and consumer research; development and allocation of advertising budget, organization and functions of advertising agency, choice of advertising appeals; selection of media; preparation of advertisements — copy and layout. I, II; 3 hours, or ½ unit. Graduate students will not receive credit for both Journalism 384 and 387. Prerequisite: Marketing 381, or Journalism 281. Mr. Marien, Mr. Wedding.

385. Advertising Promotion and Sales. Same as Marketing 385. Sales problems, advertising promotion, advertising research, market research. I, II; 3 hours, or ½ unit. Prerequisite: Journalism 382. Mr. McClure.

386. Radio Advertising. Same as Marketing 386. Economics, standards, and ethics as applied to radio commercials; sponsorship, rates, and advertising techniques, including merchandising, marketing, servicing, and sales; preparation and presentation of radio advertising copy, measurements, and listener surveys. I, II; 2 hours, or ½ unit. Prerequisite: Journalism 281, or Marketing 381. Mr. Sandage.

387. Advertising Policies and Problems. Same as Marketing 387. Analysis of

actual advertising situations and study of how such situations were or might have been met. Consideration given to management and technical problems at both the national and retail levels. I, II; 3 hours, or ½ to 1 unit. Graduate students will not receive credit for both Journalism 384 and 387. Prerequisite: Journalism 281, or Marketing 381.

LABOR AND INDUSTRIAL RELATIONS

The Institute offers a degree of Master of Arts in Labor and Industrial Relations through an integrated curriculum including relevant courses in a number of cooperating departments. In addition, it cooperates with other departments in providing a curriculum leading to a Doctor of Philosophy degree in the various fields of the social sciences with a major emphasis on labor and industrial relations.

Students who wish to become candidates for the master's degree must receive the approval of the Director of the Institute on meeting the following prerequisites: A minimum of twenty-one hours in the social sciences, of which at least nine should be in economics. The social sciences include economics, history, philosophy, political science, psychology, and sociology. At least three hours credit in statistics and three hours credit in labor economics or labor problems are to be included in the total of twenty-one hours.

Students who can not meet these requirements may register for graduate work, but must remove any deficiency during the first year of residence by taking the prescribed courses without graduate credit, unless exempted for reasons satisfactory to the advisor in charge.

The candidate for the Master of Arts degree in Labor and Industrial Relations must complete eight units of graduate credit. These must include one unit in the Research Seminar (Labor and Industrial Relations 493), two units devoted to the writing of a thesis, and five units to be selected from appropriate courses in the four principal areas of study: Human Relations in Industry, Labor Economics, Labor Union Organization and Administration, and Personnel Management. With the approval of the Institute, the courses to meet the five-unit requirement may be selected from a considerable number of courses given not only in the Institute but also in other departments of the University. (See General Announcement of the Institute.) The thesis requirement can be waived only on the specific consent of the Director, in accordance with the general rules of the Graduate College.

In addition to the eight units referred to above, the candidate for the master's degree is required to work for a minimum of three months in industry in the status of an employee. The student planning to become a candidate for the master's degree is urged, after consultation with the Director, to secure his work experience shortly before registering in the Institute. Work experience undertaken previous to graduate work in the Institute may be submitted for appraisal in lieu of the internship requirement.

Graduate Teaching Faculty

Professors: P. Bradley (Director of Institute of Labor and Industrial Relations), E. B. McNatt, W. H. McPherson, R. Stagner.

Associate Professors: W. E. Chalmers, M. Derber, R. Dubin, L. M. McQuitty, J. B. Parrish, L. C. Pigage.

Associates: J. M. Edelman, D. E. Wray.

Courses for Graduates

418. Seminar in Human Relations in Industry. Same as Sociology 418. Individual research in sociological interpretation of industrial organization; the orientation and motivation of the individual in industry and commerce; labor-management relations as group adjustments; the interrelations of industry and the community. I; 1 unit. Prerequisite: Six hours of sociology including Sociology 318, or consent of instructor. Mr. Wray.

420. Formation of Public Policy. Same as Political Science 420. An examination of the institutional and dynamic forces that shape the making of policy and its administration in the United States; separation of powers, pressure groups, administrative and legal procedures, judicial activity. I or II; 1 unit. Mr. Hagen.

440. Labor Economics. Same as Economics 440. A critical economic analysis of contemporary English and American wage theory, employment and unemployment, and collective bargaining, with emphasis on public policy. I; 1 unit. Prerequisite: A minimum of 6 hours in economics. Mr. McNatt.

441. Labor Economics. Same as Economics 441. A critical economic analysis of contemporary English and American wage theory, employment and unemployment, and collective bargaining, with emphasis on public policy. II; 1 unit. Prerequisite: A minimum of 6 hours in economics. Mr. McNatt.

442. Problems and Practices in Collective Bargaining. Same as Economics 442. Seminar in the methods and techniques of collective bargaining in the negotiation of the labor contract; nature and significance of labor agreements; union, management, and public interests in major contract provisions. I; 1 unit. Prerequisite: Consent of instructor. Mr. McPherson.

443. Problems and Practices of Labor Dispute Settlement. Same as Economics 443. Seminar in the techniques of labor contract administration; comparative study of grievance procedure operation; analysis of conciliation, fact-finding, and arbitration procedures, including case studies of arbitration awards. II; 1 unit. Prerequisite: Consent of instructor. Mr. McPherson.

447. Labor Union Organization and Administration. Same as Economics 447. Analysis of the structure and government of the modern American trade union movement with particular reference to the relations between organization and function. Problems relating to the function and execution of economic policies, the maintenance of unity and discipline, the adjustment of jurisdictional conflicts, the observance of agreements will be examined and appraised. II; 1 unit. Prerequisite: Major in social sciences, or consent of instructor. Mr. Chalmers.

448. Problems of Personnel Administration. An examination of the organization and administration of the personnel function in management. The course will deal with the relations of personnel administration to operating departments, and the scope of business and industrial personnel services. Analytical appraisal of policies and practices in selected areas of personnel administration, such as selection and training, will be carried out through case studies and direct industrial contacts. Specific consideration will be given to prob-

lems up to and including placing the person on a job. I; 1 unit. Prerequisite: Economics 248, or equivalent; consent of instructor. Mr. Bradley, Mr. Pigage.

449. Problems of Personnel Management. Same as Management 449. A seminar and laboratory course dealing with the problems and practices encountered by personnel managers subsequent to the employment process. Students will do field work in businesses and industries in the area on such topics as incentives, rating, employee services, and community relations. II; 1 unit. Prerequisite: Economics 240, 248, and Management 301; or Labor and Industrial Relations 448.

491. Thesis Seminar. For all students writing theses in labor and industrial relations. I; ½ to 2 units. Graduate Staff.

492. Thesis Seminar. For all students writing theses in labor and industrial relations. II; ½ to 2 units. Graduate Staff.

493. Research Seminar in Labor and Industrial Relations. Systematic analysis of theories and procedures of the various social and physical sciences bearing on research in labor and industrial relations. Although the experience of students, including term papers and theses in process, will be utilized, primary emphasis will be on the process of integrating the approaches and techniques of all the social sciences with respect to the study of problems in labor and industrial relations as met in practice, in management, the union, and government service, as well as in teaching and research in the field. I, II; 1 unit. Prerequisite: Major in social sciences, or consent of instructor. Mr. Derber.

Courses for Graduates and Advanced Undergraduates

312. Problems of Administration and Organization. Same as Management 312. Problems of the individual and groups brought about by modern industrial organizations and techniques. Motivations for work and cooperation between executives and different economic and social groups. I, II; 3 hours, or ½ unit. Prerequisite: Management 101, or equivalent. Mr. Dubin.

318. Human Relations in Industry. Same as Sociology 318. Sociology of industry and problems of personal adjustment. The emergency of modern industrial and labor organizations and their impact upon community life. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Senior standing; Psychology 100, Sociology 100, or consent of instructor. Mr. Dubin, Mr. Wray.

342. Economics of Social Security. Same as Economics 342. A critical analysis of the economic issues and problems involved in our legislative efforts to reduce the economic risks of unemployment, old age dependency, and industrial injury. I; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108; junior standing. Mr. McNatt.

343. The Labor Market. Same as Economics 343. Economic analysis of the labor market, its structure, characteristics, and operations in contrast with other markets; factors making for equilibrium and disequilibrium; migration; occupational and industrial mobility; labor market research including techniques and materials. II; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102 or 108 and 240; junior standing. Mr. Parrish.

344. The Law and Labor. Same as Economics 344. An economic analysis of the problems and issues arising out of the legislative and judicial efforts to define the rights, duties, and responsibilities of labor organizations and management in the field of industrial relations. II; 3 hours, or ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108; Economics 240; junior standing. Mr. McNatt.

346. Foreign Labor Movements. Same as Economics 346. Analysis of the history, organization, economic policies, political programs, and domestic, international, and contemporary influence of the labor movements of Great Britain, Sweden, Germany, France, Latin America, and Russia. I; 3 hours, or ½ to 1 unit. Prerequisite: Economics 240; junior standing. Mr. Chalmers.

365. Administration of Federal Labor Law. Same as Political Science 365. Role of administration in the effectuation of public policy; organization and procedures of major federal labor agencies; types of policies formulated by federal labor agencies. Experience of bureaus of Department of Labor, National Labor Relations Board, United States Employment Service, National Mediation Board, War Labor Board, and others. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Political Science 150. Mr. Edelman.

380. Labor Law. Same as Law 380. The law of industrial relations with special emphasis on recent cases and legislation; collective bargaining and labor contracts; wages and hours legislation; unemployment compensation. II; 1 unit. Mr. Sullivan.

LANDSCAPE ARCHITECTURE

(Including City Planning)

The Department of Landscape Architecture offers graduate work leading to the Master of Arts and Master of Science degrees only.

Master of Arts in Landscape Architecture. The prerequisite for graduate work in landscape architecture is a bachelor's degree in landscape architecture substantially equivalent to the degree conferred by the University of Illinois.

To qualify for this degree a student must take the seminar and thesis course for four units, and at least four additional units chosen from the following:

	UNITS
Architecture (advanced undergraduate courses in design or history)	1
Botany (advanced undergraduate or graduate courses)	1
Civil Engineering 423—Highway Traffic, Transport, and Safety	1
Landscape Architecture 436 — Landscape Design	1–2
Landscape Architecture 447 — Landscape Construction	1–2
Landscape Architecture 457 — Advanced Planting Design	1–2

Master of Science in City Planning. College graduates in architecture, civil engineering, landscape architecture, and the social sciences are offered an opportunity to prepare themselves for careers in city, state, and regional planning. After completing their preparation they will be qualified for positions with city, metropolitan, state, and regional planning commissions and with planners in independent practice.

The prerequisite for graduate work in city planning is a bachelor's degree in architecture, civil engineering, landscape architecture, or the social sciences, and must include the following courses or their acceptable equivalent:

	HOURS
Planning of towns and cities	4
Sociology (urban, rural, or regional)	3
Political Science (municipal government or municipal problems)	3
Economics (public utilities or transportation)	3
Design (either landscape or architectural design or highway and municipal design, airport design, regional design)	12

To qualify for this degree a student must take the seminar and thesis course for four units and at least four additional units from the following:

	UNITS
Architecture 404 — Design	1
Civil Engineering 420 — Highway Engineering	1
Civil Engineering 423 — Highway Traffic, Transport, and Safety	1
Civil Engineering 424 — Airport Design	1
Civil Engineering 440 — Water Supply	1
Civil Engineering 435 — Municipal Engineering	1
Economics 405 — Public Finance	1
Economics 465 — Social Control of Business	1
Economics 492 — Economics of Transportation	1
Landscape Architecture 437 — City Planning Design	1–2
Pol. Sci. 404 — Municipal Administration	1
Pol. Sci. 413 — State Government	1
Sociol. 414 — Public Opinion	1

Graduate Teaching Faculty

Professors: O. G. Schaffer (Head of Department), H. Bartholomew, K. B. Lohmann, S. H. White.

Associate Professor: Florence B. Robinson.

Courses for Graduates

436. Advanced Landscape Design. Landscape design of large private, semi-public, and public properties. I, II; 1 to 2 units. Mr. White.

437. City Planning Design. Analysis and synthesis of problems and possibilities in the layout of average towns and cities and their surroundings. I, II; 1 to 2 units. Mr. Lohmann.

447. Advanced Landscape Construction. Construction problems connected with large private and public landscape developments. I, II; 1 to 2 units. Mr. Schaffer.

457. Advanced Planting Design. Theory and application of planting design in relation to private, semi-public, and public properties. I, II; 1 to 2 units. Miss Robinson.

487. Seminar. I; ½ unit. Mr. Lohmann and others.

488. Seminar. II; ½ unit. Mr. Lohmann and others.

491. Thesis. I; 1½ units. Staff.

492. Thesis. II; 1½ units. Staff.

LIBRARY SCIENCE

The purpose of the Library School is to prepare young men and women for careers as professional librarians in all types of libraries. Programs of study may be followed leading to the master's and the doctor's degree in Library Science.

Following suitable undergraduate preparation in general educational subjects as well as professional library courses, a fifth year of advanced professional study, combined with some advanced non-library studies, leads to the degree of Master of Science in Library Science. This degree represents the minimum academic preparation for professional librarianship.

Experienced librarians of marked professional capacity and promise may pursue a program of advanced study and research leading to the degree of Doctor of Library Science. The normal minimum period of study is the equivalent of two years beyond the master's degree.

Students holding bachelor's degrees from any accredited institution but without previous course work in library science are eligible for admission to the master's program upon completion of a portion of the pregraduate professional core. Normally, this may be accomplished in any regular summer session.

Students holding bachelor's degrees from any accredited four-year or five-year library school may be admitted directly to the master's program without further course work.

Degree of Master of Science in Library Science. In addition to the regular requirements for admission to the Graduate College, the student must also fulfill the following minimum requirements before he will be permitted to register for advanced work in library science:

(1) Successful completion of a professional program in an accredited library school, either graduate or undergraduate, or equivalent training satisfactory to the Library School; *or*

(2) Successful completion of a basic core of three professional courses offered by the Library School each summer session of eight weeks. A scholastic average of at least 3.5 (C+) must be made in these courses.

(3) By the end of the senior year, students should have completed a basic introductory course in each of the following subjects: Sociology, psychology, education, American government, public administration, and economics. An elementary course in statistics is recommended for all graduate students and will be required of students who wish to enter the doctoral program.

If deficiencies occur, the Library School, after evaluation of the student's undergraduate program, will indicate which courses, if any, must be cleared before admission. It is possible for some deficiencies to be made up after conditional admission to the Graduate College.

(4) A reading knowledge of one modern foreign language. Students specializing in bibliographical work and in college or university library administration must have a reading knowledge of at least two foreign languages and statistics.

(5) Evidence of ability to pursue graduate work in library science.

All students whose undergraduate professional training was completed at institutions other than the University of Illinois will be given, at the beginning of the semester in which they enter, a placement examination in the basic principles

and techniques of librarianship. The results of this examination will be used in determining the student's program of study.

Correspondence regarding admission should be addressed to the Assistant Director of the Library School from whom the necessary application blanks can be secured. All applications, transcripts, and other necessary papers should be filed as early as possible, and not later than four weeks before the date of registration. No student should complete his plans for attending the Library School until he has been notified of his admission.

At least two semesters in residence or the equivalent, and the completion of nine units of graduate work are required. Four to five units constitute a normal semester program for the master's degree. A student who receives two units of a grade below "B" during his first year of graduate work may not complete the residence requirements in one year by carrying the minimum program of nine units for the master's degree. Three units of a grade below "B" disqualify a student as a candidate for a degree.

No thesis is required but each student will designate one of his regular course papers as his master project. The subject of this paper will be determined by the student and approved by the instructor of the course in which it is to be written. The title of the paper is to be filed in the Library School office not later than two weeks after the start of the semester in which the student expects to graduate. Two typewritten copies of this report are to be prepared, one for the instructor of the course and the other to be deposited in the Office of the Assistant Director of the Library School not later than two weeks before the date on which the degree is to be conferred.

No courses are required, but each student's program of study will be developed for his particular needs and purpose. At the time of registration each student will be assigned an advisor from the Library School faculty. As the first step in registration, the student, in consultation with his advisor, will decide upon his program for at least the first semester. Governed by his previous training, the student will be encouraged to take a portion of his course work outside the Library School.

Degree of Doctor of Library Science. A student desiring to pursue a program of study and research leading to the degree of Doctor of Library Science must meet the customary admission requirements of the Graduate College. In addition, he must meet the following requirements of the Library School:

(1) A master's degree in library science from an accredited library school or an equivalent acceptable to the Library School.

(2) A substantial period of acceptable professional library experience.

The normal minimum period of study required for the degree of Doctor of Library Science is two years beyond the master's degree, during which the student is required to devote all his working time to studies. All three years must be spent in resident graduate study at some accredited educational institution, and either the first two or the last one of the three must be spent at the University of Illinois. The degree is conferred, however, not for residence during a certain period, but for scholarly attainments and power of investigation, as proved by a thesis and examinations.

The remaining general requirements for this degree in respect to residence, language requirements, academic program and thesis are the same as that for the Doctor of Philosophy degree.

Fellowships and Assistantships

Katharine L. Sharp Fellowship. Endowed in 1933 by the Illinois Library School Alumni Association as a memorial to the founder of the School, the Katharine L. Sharp Fellowship is awarded on recommendation of the faculty. It carries a stipend of $600 and exemption from tuition. The fellowship is awarded only to students who are working for the Master of Science degree.

Assistantships. Several assistantships in the University Library and in the Library School are open each year to properly qualified candidates. Graduate students in the Library School who have completed the bachelor's degree with eighteen hours of library science or its equivalent are eligible for part-time academic appointments to the Library staff. Appointments are made for one year and may be renewed once. Half-time appointments require twenty hours of work each week at duties assigned by the Director of the Library and Library School; three-quarter time appointments require thirty hours. The minimum stipend for a half-time assistantship is $1,200 a year; for a three-quarter time appointment, $1,800.

Graduate Teaching Faculty

Professors: R. B. Downs (Director of Library School), A. H. Lancour.

Associate Professors: L. E. Bamber, Ethel Bond, Anne M. Boyd, H. Goldhor, Josie B. Houchens, A. M. McAnally.

Assistant Professors: Marie M. Hostetter, M. Alice Lohrer, Rose B. Phelps.

Courses for Graduates

401. Communications. Introduction to the study of the mass media of communications (print, radio, and film) in modern society. The basic research studies and the principal techniques are reviewed. I; 1 unit. *Prerequisite:* Completion of undergraduate library core, or equivalent.

402. The Reading of Adults. Designed to acquaint the student with the evidence on the nature of materials read by adults, on reading habits, and on the effects of reading. II; 1 unit. Prerequisite: Library Science 401.

404. The Reading of Young People. Concerned primarily with the major areas of research in the field of reading for young people. Class discussions are devoted to a critical analysis of these studies and their implications for the librarian working with children and young people. II; 1 unit. Prerequisite: Library Science 401. Miss Lohrer.

405. Library Administration. Designed to give the student a knowledge of the internal organization of various types of libraries, and of the principles of library administration. The emphasis of the course is on the comparison of the conditions found in various types of libraries, and on the application to libraries of the general theory of administration. I; 1 unit. Prerequisite: Completion of undergraduate library core, or equivalent. Mr. Lancour.

407. Cataloging. The cataloging of special types of library materials, such as maps, music, pamphlets, dissertations, serials, monographic sets, films, records, etc.; administrative problems of the catalog department. I; 1 unit.

Prerequisite: Completion of undergraduate library core, or equivalent. Miss Bond.

408. Classification and Subject Headings. Development of systems of classification for books. Problems in classification and subject headings based on the use of the decimal and the Library of Congress classifications and the Library of Congress subject headings; classification systems for special libraries; modification of classification systems; shelf listing; book numbers; administrative problems of classification and subject heading work. II; 1 unit. Prerequisite: Completion of undergraduate library core, or equivalent. Miss Bond.

410. Teaching Function of the Library. A study of the implications inherent in the concept of the library as an educational institution. A consideration of this concept as the source of a philosophy of librarianship. Study will be made of outstanding applications in the profession. II; 1 unit. Miss Boyd.

411. Bibliography of the Humanities and Social Science. Detailed study of the basic and most useful reference and bibliographic aids. Drill and practice in the use of specific titles will be given, but emphasis will be placed on understanding the uniform pattern of reference tools that exists in each of the major fields of the humanities and the social sciences. I; 1 unit. Prerequisite: Completion of undergraduate library core, or equivalent. Miss Phelps.

412. Bibliography of Science and Technology. Detailed study of the basic and most useful reference and bibliographic aids. Drill and practice problems in the use of specific titles will be given but emphasis will be placed on understanding the uniform pattern of reference tools that exists in each subject field. II; 1 unit. Prerequisite: Completion of undergraduate library core, or equivalent. Miss Phelps.

425. Methods of Investigation. The elements of scientific investigation with emphasis on the principal methods of research applicable to the problems of librarianship. The course is designed to prepare producers, not consumers, of research. Knowledge of elementary statistical methods is prerequisite for admission. I; 1 unit. Mr. Goldhor.

426. Advanced Classification and Cataloging. History and philosophy of classification and cataloging of books; comparative study of classification systems, of lists of subject headings, and of cataloging rules; cataloging and classification of more difficult types of materials; administrative problems of catalog departments. II; 1 unit. Prerequisite: Library Science 407 and 408. Miss Bond.

427. Resources of American Libraries. The aims of this course are to acquaint the student with the distribution and extent of American library resources for advanced study and research; methods of surveying library facilities; growth and use of union catalogs and bibliographical centers; inter-institutional agreements for specialization of collections and other forms of library cooperation; types of library materials; and ways and means of developing research collections in special subject fields. I; 1 unit. Mr. Downs.

428. The Physical Problems of Libraries. Consideration of the principles of design, layout, and physical organization of the main types of libraries, and

of recent relevant developments in architecture and engineering. II; 1 unit. Mr. Goldhor.

429. Government Publications. The nature and scope of American and British government publications; the problems of their organization because of form, production, and distribution. I; 1 unit. Miss Phelps.

430. Advanced Reference Service. Designed to enable the student to utilize the varied resources of a large research library; methods of analyzing and solving bibliographic problems such as arise in scholarly libraries and in connection with research projects. II; 1 unit. Prerequisite: Library Science 429. Miss Phelps.

431. Larger Units of Library Organization. Study of library cooperation, library consolidation, and the provision of library service by units serving more than a local area. Emphasis is on the legal and administrative aspects, and on public libraries. I; 1 unit. Mr. Goldhor.

432. History of Books and Printing. The origin and evolution of the alphabet and of scripts; the history of manuscript books; the invention and spread of printing; the history of the production and distribution of printed books; the history of ancient and medieval libraries in relation to the collection and preservation of books. Emphasis is placed on the relation of the book to the social conditions of the various periods studied. II; 1 unit. Miss Houchens.

433. Biological Literature and Reference Work. An introduction to the use of the indexes and abstract journals in the biological sciences and related fields. Use of general library aids, preparation of scientific manuscripts, and history of scientific societies are also considered. I, II; ¼ unit. Prerequisite: Consent of instructor. Mr. Bamber.

451. Problems in Reference Service. Designed to examine the assumptions on which the interpretation of library resources is based, to consider the objectives of such a service and the policies which will lead to their attainment. I; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent. Miss Phelps.

452. Education for Librarianship. A study of the development of library education in this country and abroad. Not a course in teaching method but designed to provide an understanding of the philosophical foundations of the several training agencies through an analysis of their methods, content, character of personnel, and relationship to the profession at various times. II; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent. Mr. Lancour.

453. Problems in Cataloging and Classification. An analysis of the major technical and organizational problems of cataloging and classification. Not a course in methods but the careful study of the best and latest thinking through reading and discussions of the persistent problems in this area of librarianship. Individual studies on selected topics. I; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent. Miss Bond.

454. College and University Library Problems. Analysis and investigation of administrative and educational problems in college and university libraries.

II; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent. Mr. McAnally.

455. Studies in Reading. Critical analysis of the assumptions and problems of the reading process of young people and adults with reference to its applications to library work. I; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent.

456. Public Library Problems. Critical analysis of the major problem areas in the administration and organization of public libraries. II; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent. Mr. Goldhor.

457. Librarianship and Society. The emphasis of this course is on the place of libraries today as a social institution and in relation to social trends. Consideration is given to the role of the librarian as an individual and as a professional worker in contemporary society. I; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent. Mr. Lancour.

458. School Library Problems. A critical analysis of the current practices and major problems confronting the school library field. II; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent.

491. Thesis. Individual study and research for doctoral candidates. I; 1 to 4 units. Mr. Downs, Mr. Goldhor, Mr. Lancour, Miss Phelps.

492. Thesis. Individual study and research for doctoral candidates. II; 1 to 4 units. Mr. Downs, Mr. Goldhor, Mr. Lancour, Miss Phelps.

Courses for Graduates and Advanced Undergraduates

301. Literature of the Humanities and Social Sciences. The purpose of this course is to increase the student's knowledge of book content in the social sciences and the humanities by reading and study of representative selections. Attempts only an introduction to a wide variety of the more important modern titles in these fields, with emphasis on the student's understanding the use of this knowledge of book content in library processes. I; 3 hours, or 1 unit. Miss Boyd.

302. Literature of Science and Technology. A survey of the several fields of pure and applied science and a study of the literature of each field. Designed to give the student an understanding of the content of each of the scientific disciplines and its role and place in modern society. Selected readings from the oustanding works in each field will acquaint the student with the principal sources. II; 3 hours, or 1 unit. Miss Boyd.

303. Library Materials for Children. Introduction to the use of books and materials in children's libraries and in the elementary school program. The course has as its objectives a knowledge of and appreciation for children's literature; an acquaintance with standard aids in book selection for children; the development of judgment in fitting books to pupil needs and ability to select and integrate books and materials vital to the school curriculum. I, II; 3 hours, or 1 unit. Miss Hostetter, Miss Lohrer.

304. Library Materials for Adolescents. The course has as its objective a knowledge of and appreciation of literature for adolescents; an acquaintance

with standard aids in book selection for adolescents in public and high school libraries; the development of judgment in fitting books to pupil needs, and the ability to select and integrate books and materials vital to the school curriculum. I, II; 3 hours, or 1 unit. Miss Hostetter, Miss Lohrer.

306. Maps and Cartobibliographical Aids. An examination of the problems involved in the cataloging, classification, and care of maps. The student will become acquainted with the major cartobibliographical and related aids in the field. II; 2 hours, or ½ unit. Mr. Ranz.

MATHEMATICS

The Department of Mathematics offers graduate work leading to the Master of Science and Doctor of Philosophy degrees.

Students beginning graduate study with a major in mathematics must have had twenty hours of undergraduate work in mathematics besides the usual freshman courses in algebra, trigonometry, and analytic geometry, including a one-year course in calculus and one year of more advanced work in one or more of the fields of algebra, analysis, and geometry. They should be able to read German or French.

Candidates for a Doctor of Philosophy degree taking a first minor in mathematics are expected to have completed a course in calculus and are required to take two one-year courses beyond the calculus. Those taking a second minor are required to complete at least one course throughout a year beyond the calculus.

The more technical courses offered by the department are arranged mainly in cycles of two or of three years, so that a properly qualified student will usually have opportunity to take any particular course at some time during the three years of residence required for the doctor's degree.

Candidates for the degree of Master of Science in the Teaching of Mathematics must earn four units in mathematics (two units of which are electives), two units in education, and two units in electives. Requirements are Mathematics 317 or 327, 1 unit; Mathematics 400 or 328, 1 unit; Education 400, Philosophy of Education, or Education 302, History of American Education, 1 unit; and Education 409, Advanced Educational Psychology, 1 unit. The elective courses in mathematics and the other electives must be selected with the approval of the advisor. The electives may be in mathematics, in education, or, in exceptional cases, in other fields. The advisor for candidates for this degree is Professor H. R. Brahana, 251 Mathematics Building.

Candidates for the degree of Master of Science in the Teaching of Mathematics and the Physical Sciences must earn two units in mathematics, one unit in chemistry, one unit in physics, two units in education, and two units in electives. Requirements are Mathematics 347 or 343, 1 unit; Mathematics 348 or 345, 1 unit; Chemistry 240, Physical Chemistry, 1 unit; Physics 322, Theoretical Mechanics, 1 unit; Education 400, Philosophy of Education, or Education 302, History of American Education, 1 unit; and Education 409, Advanced Educational Psychology, 1 unit. The electives may be in mathematics, in education, in chemistry, or in physics. The advisor for candidates for this degree is Professor H. R. Brahana, 251 Mathematics Building.

Graduate Teaching Faculty

Professors: S. S. Cairns (Head of Department), R. Baer, D. G. Bourgin, H. R. Brahana, J. L. Doob, L. Hua, P. W. Ketchum, W. G. Madow, H. J. Miles, A. H. Taub, W. J. Trjitzinsky.

Associate Professors: M. M. Day, H. Levy, C. W. Mendel, J. W. Peters.

Assistant Professors: Beulah M. Armstrong, O. K. Bower, A. G. Carlton, Josephine H. Chanler, W. A. Ferguson, G. P. Hochschild, V. A. Hoersch, J. Landin, B. E. Meserve, Josephine M. Mitchell, M. E. Munroe, Echo D. Pepper, I. Reiner, L. Schoenfeld, L. L. Steimley, H. E. Vaughan, W. Wilson.

Instructors: W. F. Atchison, M. K. Fort, Jr., Corinne Hattan, F. E. Hohn, R. G. Langebartel, Irma M. Reiner, Jewell Schubert, E. J. Scott.

Courses for Graduates

Note: The graduate mathematics program is undergoing a rather extensive revision which has not been completed in time to be included in this catalog. The reader who is interested in the specific courses being offered is invited to address any inquiry to Professor S. S. Cairns, Head of the Department of Mathematics, University of Illinois, Urbana.

401. The Elements of Higher Geometry and Algebra. I; 1 unit. Prerequisite: Mathematics 132 and 142. Mr. Landin.

402. The Elements of Higher Geometry and Algebra. II; 1 unit. Prerequisite: Mathematics 401. Mr. Landin.

411. Algebra. I; 1 unit. Prerequisite: Mathematics 318 or 402. Mr. Baer.

412. Algebra. II; 1 unit. Prerequisite: Mathematics 317 and 318, or 402. Mr. Baer.

415. Theory of Groups. I; 1 unit. Mr. Brahana.

416. Theory of Groups. II; 1 unit. Mr. Brahana.

417. Theory of Numbers. I; 1 unit. Mr. Hua.

418. Theory of Numbers. II; 1 unit. Mr. Hua.

421. Geometry. I; 1 unit. Prerequisite: Mathematics 327 and 328, or 402. Mr. Levy.

422. Geometry. II; 1 unit. Prerequisite: Mathematics 421. Mr. Levy.

423. Advanced Geometry. I; 1 unit.

424. Advanced Geometry. II; 1 unit.

425. Fundamentals of Geometry. I; 1 unit. Mr. Baer.

426. Fundamentals of Geometry. II; 1 unit.

427. Differential Geometry. I; 1 unit.

428. Differential Geometry. II; 1 unit.

429. Ideal Theory and Algebraic Varieties. A study of those advanced topics in modern algebra which are essential for algebraic geometry. II; 1 unit. Prerequisite: Either Mathematics 411 and 412 or 421 and 422.

431. Advanced Topics in Algebraic Geometry. Seminar course. I; 1 unit. Prerequisite: Mathematics 423, 424, and 429.

432. Advanced Topics in Algebraic Geometry. Seminar course. II; 1 unit. Prerequisite: Mathematics 423, 424, and 429.

441. Analysis. I, II; 1 unit. Prerequisite: Mathematics 348, or equivalent. Mr. Doob.

442. Analysis. II; 1 unit. Prerequisite: Mathematics 441. Mr. Doob.

443. Functions of Real Variables. I; 1 unit.

444. Functions of Real Variables. II; 1 unit.

445. Functions of a Complex Variable. I; 1 unit. Mr. Doob.

446. Functions of a Complex Variable. II; 1 unit. Mr. Doob.

447. Topics in Classical Analysis. I; 1 unit.

448. Topics in Classical Analysis. II; 1 unit.

449. Differential Equations. I; 1 unit.

450. Differential Equations. II; 1 unit.

451. Linear Operations. I; 1 unit. Prerequisite: Mathematics 348; one and one-half years of mathematics past calculus.

452. Linear Operations. II; 1 unit. Prerequisite: Mathematics 347 and 348; one and one-half years of mathematics past calculus.

453. Advanced Topics in the Theory of Functions. I; 1 unit. Mr. Trjitzinsky.

454. Advanced Topics in the Theory of Functions. II; 1 unit. Mr. Trjitzinsky.

455. Analysis in Function Space. Analysis in domains more general than finite linear spaces, with particular reference to nonlinear operators and equations. Specializations yield an integrated account of classical real and complex variable theory. I; 1 unit. Prerequisite: Mathematics 441 and 442.

456. Analysis in Function Space. Analysis in domains more general than finite linear spaces, with particular reference to nonlinear operators and equations. Specializations yield an integrated account of classical real and complex variable theory. II; 1 unit. Prerequisite: Mathematics 441 and 442.

457. Topology. I; 1 unit. Mr. Cairns.

458. Topology. II; 1 unit. Mr. Cairns.

461. Theory of Probability. I; 1 unit.

462. Theory of Probability. II; 1 unit.

487. Applied Mathematics. I; 1 unit. Prerequisite: Mathematics 387 and 388, or 347 and 348. Mr. Ketchum.

488. Applied Mathematics. II; 1 unit. Prerequisite: Mathematics 387 and 388, or 347 and 348. Mr. Ketchum.

491. Seminar and Thesis. I; 1 to 2 units. Staff.

492. Seminar and Thesis. II; 1 to 2 units. Staff.

Courses for Graduates and Advanced Undergraduates

301. Fundamental Concepts of Mathematics. I; 3 hours, or 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147. Mr. Meserve.

302. Fundamental Concepts of Mathematics. II; 3 hours, or 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147. Mr. Meserve.

303. Foundations of Mathematics. The process of proof applied to some fundamental domains of mathematics, and a discussion of recent criticisms of the foundations of mathematics. I; 3 hours, or 1 unit. Prerequisite: Junior standing; consent of instructor. Mr. Vaughan.

304. Foundations of Mathematics. Continuation of Mathematics 303. The process of proof applied to some fundamental domains of mathematics, and a discussion of recent criticisms of the foundations of mathematics. II; 3 hours, or 1 unit. Prerequisite: Mathematics 303. Mr. Vaughan.

311. Advanced Algebra. For students interested in actuarial science, statistics, or teacher training in mathematics. I; 3 hours, or 1 unit. Prerequisite: Mathematics 142, or consent of instructor. Mr. Ferguson, Mr. Miles.

312. Advanced Algebra. For students interested in actuarial science, statistics, or teacher training in mathematics. II; 3 hours, or 1 unit. Prerequisite: Mathematics 142, or consent of instructor. Mr. Ferguson, Mr. Miles.

317. Introduction to Higher Algebra. I; 3 hours, or 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147. Mr. Hochschild.

318. Introduction to Higher Algebra. II; 3 hours, or 1 unit. Prerequisite: Mathematics 317. Mr. Hochschild.

327. Introduction to Higher Geometry. I; 3 hours, or 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147. Miss Chanler.

328. Introduction to Higher Geometry. II; 3 hours, or 1 unit. Prerequisite: Mathematics 327. Miss Chanler.

341. Differential Equations. I, II; 3 hours, or 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147. Mr. Steimley.

342. Differential Equations. I, II; 3 hours, or 1 unit. Prerequisite: Mathematics 341. Mr. Steimley.

343. Advanced Calculus. I, II; 3 hours, or 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147.

345. Differential Equations and Orthogonal Functions. I, II; 3 hours, or 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147.

347. Introduction to Higher Analysis. I, II; 3 hours, or 1 unit. Prerequisite: One year of mathematics beyond calculus, or consent of instructor.

348. Introduction to Higher Analysis. I, II; 3 hours, or 1 unit. Prerequisite: Mathematics 347.

361. Theory of Probability. II; 3 hours, or 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147. Mr. Munroe.

363. Advanced Statistics. Probability and statistical inference. I; 3 hours, or 1 unit. Prerequisite: Mathematics 132 and 142. Mr. Carlton.

364. Advanced Statistics. Probability and statistical inference. II; 3 hours, or 1 unit. Prerequisite: Mathematics 363. Mr. Carlton.

365. Statistical Inference. Theory of estimation and tests of statistical hypotheses. I; 3 hours, or 1 unit. Prerequisite: Mathematics 363 and 364, or 361. Mr. Carlton.

366. Theory of Sample Surveys. The development of the formulae to be used in the efficient planning of sample surveys and the interpretation of the results. I and/or II; 3 hours, or 1 unit. Prerequisite: Calculus or Mathematics 112 and a first course in statistics; junior standing. Mr. Madow.

367. Practice of Sample Surveys. Training in planning and making sample surveys. How the results are interpreted. One or more sample surveys will be planned in detail. I and/or II; 3 hours, or 1 unit. Prerequisite: Calculus or Mathematics 112 and a first course in statistics; junior standing. Mr. Madow.

368. Statistical Methods of Quality Control. Theory of samples related to quality control, statistical techniques in quality control; sequential analysis of data. II; 3 hours, or 1 unit. Prerequisite: Mathematics 161. Mr. Bower.

371. Actuarial Theory. I; 3 hours, or 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147. Mr. Peters.

372. Actuarial Theory. II; 3 hours, or 1 unit. Prerequisite: Mathematics 371. Mr. Peters.

381. Vector and Tensor Analysis. I; 3 hours, or 1 unit. Prerequisite: Mathematics 142 and 343, or equivalent, or consent of instructor. Mr. Bourgin.

382. Vector, Tensor, and Matrix Methods in Applied Mathematics. II; 3 hours, or 1 unit. Prerequisite: Mathematics 381, or consent of instructor. Mr. Bourgin.

385. Theory of High Speed Computing Machines. The logical design of various types of high speed computing machines. The preparation of problems for such machines. II; 3 hours, or 1 unit. Prerequisite: Senior standing; consent of instructor. Mr. Taub.

387. Introduction to Applied Mathematics. Applications of mathematical methods to engineering problems. I; 3 hours, or 1 unit. Prerequisite: Mathematics 132 and 142, or equivalent. Mr. Ketchum, Mr. Langebartel, Mr. Scott.

388. Introduction to Applied Mathematics. Applications of mathematical methods to engineering problems. II; 3 hours, or 1 unit. Prerequisite: Mathematics 132 and 142, or equivalent. Mr. Ketchum, Mr. Langebartel, Mr. Scott.

MECHANICAL ENGINEERING

The Department of Mechanical Engineering offers graduate work leading to the Master of Science and Doctor of Philosophy degrees. Advanced study and professional training are offered in the general fields of power, design, and production. The prerequisite for graduate work in mechanical engineering is the equivalent of the undergraduate course required for the degree of Bachelor of Science in mechanical engineering in the branch of the subject in which registration is desired. Courses offered to junior and senior students are open for minor credit to students whose major is in other departments. Courses numbered in the 300 group are those open to advanced undergraduates and graduate students, and those in the 400 group are for graduate students only. In registering for a course with variable credit, as one-half to one and one-half units, each student puts on his program card the number of units for which he intends to take the course. Courses numbered in the 300 group have variable credits of one-half to three-fourths unit; the one-half unit represents credit for work corresponding to advanced undergraduate study; the additional one-fourth unit requires a term paper.

Except under unusual circumstances the maximum number of credits which will be permitted in any course ending in 8 or 9 will be three units towards the requirements for a master's degree. An additional four units of credit will be permitted for candidates working towards a doctor's degree. In most cases the research work conducted in these laboratory investigations can be reported in the thesis submitted for fulfillment of the requirements for each degree. A minimum of eight units must be completed for the degree when a thesis is included. The requirement of a thesis may be waived in exceptional cases, but a minimum of nine units is required if a thesis is not included. For further information see the booklet "Graduate Study and Research in Mechanical Engineering."

Fellowships

The Eastman Kodak Company of Rochester, New York, has made available a graduate fellowship of $750 to worthy and needy engineers who established high scholastic records in their undergraduate work. One stipulation is that the recipient of this fellowship must be a graduate of some engineering school other than the University of Illinois.

Graduate Teaching Faculty

Professors: N. A. Parker (Head of Department), W. N. Espy, J. R. Fellows, C. W. Ham, A. E. Hershey, S. Konzo, R. F. Larson, D. G. Ryan, H. J. Schrader, W. H. Severns, K. J. Trigger.

Associate Professors: E. L. Broghamer, J. A. Henry, W. L. Hull, D. H. Krans, E. Laitala, L. C. Pigage.

Assistant Professors: H. H. Korst, R. J. Martin.

Courses for Graduates

401. Thermodynamics. Application of thermodynamics to the analysis and solution of engineering problems involving energy transfer and conversion. I; 1 unit. Prerequisite: One year course in thermodynamics. Mr. Espy.

402. Thermodynamics of Gaseous Equilibrium. Application of thermodynamics to analysis of combustion of gases used as working media in power production. II; 1 unit. Prerequisite: One year course in thermodynamics. Mr. Espy.

404. Gas Dynamics. Properties of compressible fluids, subsonic and supersonic flow, steady and non-steady motion, one-, two-, and three-dimensional problems, shock waves, special problems in connection with combustion engines. I; 1 unit. Prerequisite: Differential equations, thermodynamics, and fluid mechanics.

405. Heat Transfer. Analysis of the methods and mechanisms of heat transfer: dimensional analysis method, design of heat exchangers, transient state heat transfer. Special problems in insulation and heat transfer. I; 1 unit. Prerequisite: Undergraduate course in heat transfer. Mr. Larson.

408. Laboratory Investigations in Thermodynamics. Special investigations involving thermodynamic analysis, thermodynamic properties, and performance of physical and chemical systems. I, II; ½ to 1½ units. Prerequisite: One year course in thermodynamics and one-half year course in power laboratory. Mr. Espy and others.

409. Laboratory Investigations in Fluid Flow, Heat Transfer, and Combustion. Special investigations in flow, metering, heat transfer, heat exchanger performance and design. I, II; ½ to 1½ units. Prerequisite: Courses in thermodynamics and fluid mechanics. Mr. Larson and others.

413. Industrial Control Systems. Study of basic elements of process control systems and process characteristics, particularly of thermal and mechanical processes. II; 1 unit. Prerequisite: Mechanical Engineering 311, or equivalent.

421. Heating and Air Conditioning. Advanced study of heating, ventilating, and air conditioning. Factors affecting heat loss and heat gain of buildings, physiological effects of environment, equipment design of heat transfer equipment. Individual problems. I; 1 unit. Prerequisite: Undergraduate course in heating, ventilating, and air conditioning. Mr. Fellows, Mr. Konzo.

422. Heating and Air Conditioning Design. Factors affecting design of steam, hot water, and air systems, including pipe and duct design, heat transfer rates, and control of equipment. Special topics such as panel heating, electrical heating, radiant heating, reverse cycle refrigeration. II; 1 unit. Prerequisite: Undergraduate course in heating, ventilating, and air conditioning. Mr. Fellows, Mr. Konzo.

423. Refrigeration Theory and Application. Advanced study of processes and cycles; design problem; and special applications. II; 1 unit. Prerequisite: Undergraduate course in refrigeration. Mr. Martin.

428. Laboratory Investigations in Refrigeration. Special investigations in refrigeration. I, II; ½ to 1½ units. Mr. Martin and others.

429. Laboratory Investigation in Heating and Air Conditioning. Special investigations in heating, ventilating, and air conditioning. I, II; ½ to 1½

units. Prerequisite: Two semesters of power laboratory, or equivalent. Mr. Fellows, Mr. Konzo and others.

431. Gas Turbines and Reaction Machines. Analysis of gas turbine cycles, media, combustion, construction and operation, impulse and reaction machinery; heat exchange and insulation. II; 1 unit. Prerequisite: Undergraduate courses in thermodynamics, power equipment, and power laboratory; Mechanical Engineering 402, 404, and 405 desirable. Mr. Larson.

432. Theory of Rotary Compressors. Thermodynamical and mechanical fundamentals, compression with and without cooling, classification of compressors, similarity considerations and characteristics, principles of and computations for radial compressors, improvement in performance of integrating parts; axial flow compressors; lattice and airfoil theory; change in operating conditions of turbocompressors; regulation; rotary positive blowers. II; 1 unit. Prerequisite: Undergraduate courses in thermodynamics and fluid mechanics (Mechanical Engineering 205 and 206; Theoretical and Applied Mechanics 232 or Aeronautical Engineering 211 and 212). Mr. Korst.

438. Laboratory Investigations in Power Machinery. Special investigations in power machinery, such as turbines, engines, fans, and compressors. I, II; ½ to 1½ units. Prerequisite: One year course in power laboratory. Mr. Hull and others.

441. Machine Design. A technical application course designed to focus the previously acquired design experience on the creative problem of developing machines to perform specified functions; proper consideration of manufacturing processes involved; checking of all parts for stress, wear, vibration, fatigue, etc. I; 1 unit. Prerequisite: Undergraduate course in dynamics of machines, and one year of machine design. Mr. Ryan.

442. Product Design. A detailed analysis of the various constituent mechanisms and apparatus in power-driven machines designed for, or adapted to, special industrial operations such as those found in mass production. This analysis includes not only the machine itself and its mechanisms and auxiliary apparatus and attachments, but also such items as tools, jigs, fixtures, etc. The material and final product studied with reference to the design or modification of new machines or apparatus, or the adaptability of existing machines or apparatus, to its production. II; 1 unit. Prerequisite: Undergraduate course in dynamics of machines and one year of machine design. Mr. Ryan and others.

443. Dynamics of Machinery. A course complementary to the undergraduate course and devoted to a more detailed study of velocities, accelerations, and forces in machine parts having reciprocating, rotating, and combined motions; balancing, critical speeds, and vibrations in shafts; gyroscopic action in machines; flywheels, governors, and special topics. I; 1 unit. Prerequisite: Undergraduate course in dynamics of machines and one year of machine design.

444. Analytical Design of High-Speed Engines. A study of the dynamics of high-speed engines with special reference to internal combustion engines, engine balance, crankshaft deflections, torsional vibrations. II; 1 unit. Pre-

requisite: Undergraduate course in dynamics of machines and one year of machine design. Mr. Broghamer.

445. Design of Internal Combustion Engines. Detailed study of the design of the internal combustion engine; gas-pressure and inertia-force diagrams; determination of bearing loads; torsional vibration analysis; stress determinations and design of important parts, including piston, connecting rod, crankshaft, flywheel, valve mechanism, and cam layout. II; 1 unit. Prerequisite: Undergraduate course in dynamics of machines, one year of machine design, and undergraduate course in internal combustion engines. Mr. Hull.

446. Power Plant Design. A design course covering the selection of equipment, and problems involved in the design and layout of a modern power plant. II; 1 unit. Prerequisite: Undergraduate courses in machine design and power. Mr. Ryan.

448. Laboratory Investigations in Machine Design. Special investigations in machine design. I, II; ½ to 1½ units. Mr. Broghamer, Mr. Ryan.

451. Materials Processing. The theory and practice of metal cutting and forming. Survey of current technical literature and special topic assignments. I; 1 unit. Prerequisite: Undergraduate courses in advanced metal processing and heat treatment of metals. Mr. Trigger.

453. Methods and Measurements of Industrial Work. Advanced theoretical analysis of factors affecting determination of economical methods, method standards, and time standards for industrial operations. Special investigations and term paper. I; 1 unit. Prerequisite: Undergraduate course in motion and time study, and production control. Mr. Laitala.

454. Production Engineering. Advanced consideration of production engineering principles as related to cost analysis and reduction, control of flow of work in manufacture, evaluation of performance against standard, and compensation. Special investigations. II; 1 unit. Prerequisite: Mechanical Engineering 453. Mr. Laitala, Mr. Pigage.

456. Measurement Standards. Precision measurements in the field of production engineering, including interference phenomena of light, dimensional measurements, physical standards of reference, gages, surface measurements, and theory of the profilometer. I; ½ unit. Prerequisite: Undergraduate courses in tool engineering and advanced metal processing, or equivalent.

458. Laboratory Investigations in Production. Special investigations in the field of production, particularly in materials, processing, and production engineering. I, II; ½ to 1½ units. Mr. Laitala, Mr. Trigger.

468. Laboratory Investigations in Railway Mechanical Engineering. Special investigations in the field of railway mechanical engineering. I, II; ½ to 1½ units. Prerequisite: Bachelor of Science degree in mechanical engineering. Mr. Schrader.

478. Laboratory Investigation in Petroleum Production Engineering. Special investigations in field of petroleum production engineering. I, II; ½ to 1½ units. Prerequisite: Bachelor of Science degree in mechanical engineering; Mechanical Engineering 371, or equivalent. Mr. Larson.

491. Thesis. (M.S. or Ph.D.). I; 1 to 2 units. Staff.

492. Thesis. (M.S. or Ph.D.). II; 1 to 2 units. Staff.

493. Seminar. Presentation and discussion of significant developments in Mechanical Engineering. I, II; no credit. Mr. Parker.

Courses for Graduates and Advanced Undergraduates

301. Engineering Thermodynamics. Application of thermodynamics to engineering processes with special attention to steady flow of a compressible medium in insulated or non-insulated ducts, availability of thermal energy, heat and power from combustion, methods of formulation and correlation of properties of a pure substance, and effect of equilibrium on the analyses of internal combustion engines and cycles. I, II; 3 hours, or ½ to ¾ unit. Prerequisite: Mechanical Engineering 205 and 206; consent of instructor. Mr. Espy.

303. Fuels and Combustion. Fuel resources; composition and specification of natural and manufactured fuels; combustion stoichiometry; fuel calorimeters; coal, oil, and gas burners; fire box and chimney design; smoke abatement. I; 3 hours, or ½ to ¾ unit. Prerequisite: Chemistry 101 and 104, or equivalent; Mechanical Engineering 207, or equivalent. Mr. Fellows.

311. Instrumentation and Measurements. Instruments and measuring equipment for flow, temperature, pressure, speed, and gas analysis. I; 3 hours, or ½ to ¾ unit. Prerequisite: Senior standing in mechanical engineering. Mr. Konzo.

314. Lubrication. The theories of lubrication; manufacture and properties of lubricants; methods of testing; lubrication methods and appliances. A study of the lubrication requirements of machines of many kinds. I; 3 hours, or ½ to ¾ unit. Prerequisite: Undergraduate courses in machine design and fluid mechanics.

332. Theory of Internal Combustion Engines. Study of thermodynamics of reciprocating engine cycles, considering such factors as chemical dissociation, heat loss, combustion chamber shape, and flow through valves and manifolds. I; 3 hours, or ½ to ¾ unit. Prerequisite: Undergraduate course in internal combustion engines. Mr. Hull.

357. Industrial Safety. Detailed study of the principles of industrial and related accident prevention and application. Course is designed to provide a sound working knowledge of safety principles for the student interested in the design or the manufacture of a product and for the student interested in entering the field of safety engineering in industry. II; 3 hours, or ½ to ¾ unit. Prerequisite: Senior standing in engineering.

361. Railway Motive Power Equipment. A technical study of the various types of motive power used on railways with special emphasis on steam, Diesel, and electric locomotives, and secondary consideration to special types such as the steam turbine, turbo-electric and gas turbine locomotives. I; 3 hours, or ½ to ¾ unit. Prerequisite: Senior standing in mechanical engineering. Mr. Schrader.

362. Railway Motive Power Operation. A study of the conditions under which railway motive power operates; economics of operation, present equipment,

proposed new equipment, servicing, and maintenance; availability; train resistance, motive power tractive force, speed time and distance curves, preparation of time tables; problems in stopping trains; terminal and repair facilities. II; 3 hours, or ½ to ¾ unit. Prerequisite: Senior standing in mechanical engineering. Mr. Schrader.

371. Petroleum Production Engineering — Field Development. Properties of petroleum, oil reservoirs, exploration and drilling methods, casing methods, and well lagging. I; 3 hours, or ½ to ¾ unit. Prerequisite: Senior standing in mechanical engineering; consent of instructor. Mr. Larson.

372. Petroleum Production Engineering. Study of reservoir performance, principle of oil and gas recovery, storage and transportation, and economics of oil field exploitation. II; 3 hours, or ½ to ¾ unit. Prerequisite: Mechanical Engineering 371. Mr. Larson.

MINING AND METALLURGICAL ENGINEERING

The Department of Mining and Metallurgical Engineering offers graduate work leading to the Master of Science and Doctor of Philosophy degrees. The prerequisite for graduate work with metallurgical engineering or mining engineering as a major is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in the major field of study at the University of Illinois. A student who is deficient in background and previous training may be required to register in certain undergraduate courses (without graduate credit) as a prerequisite to graduate work. At the time of the student's first registration his advisor will enter on a "Memorandum of Prerequisites" the undergraduate courses necessary for the student to complete.

A candidate for the degree of Master of Science is ordinarily required to have a minimum of eight units of graduate work, including a thesis. However, a degree will not be granted for this minimum if a student receives one unit of "C" unless he also receives one unit of "A," or who receives more than one unit of "C." Additional work will be required of a student who does not meet this standard.

If a petition to waive the thesis requirement is granted, a minimum of nine units of graduate work will be required.

The thesis requirement will not be waived for research graduate assistants or, in general, for assistants on research projects. For research graduate assistants and others on a half-time status, a minimum length of residence of three semesters will be required for a master's degree, regardless of the number of units of credit obtained.

In addition to the general requirements of the Graduate College for the degree of Doctor of Philosophy in Engineering, certain departmental requirements also are applicable. The languages ordinarily required of a candidate in metallurgical or mining engineering are French and German. On approval of a petition, Russian or Spanish may be substituted for French if it can be shown that in the student's special field of research the literature available in the substituted language is more significant.

Announcement of the thesis subject, with approval of the advisor, must be made at or before the beginning of the third year of study. A prerequisite to the

preliminary examination is the choice by the student of an acceptable subject for his thesis.

Before a candidate is admitted to the oral preliminary examination, he is required to pass a series of written preliminary examinations. The written examinations are given several weeks in advance of the oral preliminary examination. The written examinations are intended to discover the candidate's competence in and knowledge of his field. The examinations need not be based only on formal course work, but are intended to determine the student's knowledge of his entire field including his knowledge of previous work, history, and practice in his field of specialization.

A candidate for the degree of Doctor of Philosophy is required to pursue a major in the subject in which his research lies. He is also required to choose one minor subject, or he may choose two minor subjects. If one minor only is chosen it must be taken in a department of study other than that of the major, and credit for it may be earned by work representing not less than four units (a total of 24 units of graduate work is required for the doctorate). If two minors are chosen, one must be closely related to the major, and the second minor (not less than two units) must be taken in a department of study other than that of the major, or first minor. Acceptable minors, unless special permission is granted by petition, will be from the following subjects: physical chemistry, analytical chemistry, geology, mathematics, theoretical and applied mechanics, and physics.

Fellowships

A number of graduate fellowships in mining engineering have been established by the Sahara Coal Company. One or more are awarded each year, with a stipend of $1,000, on recommendation of the Department of Mining and Metallurgical Engineering. They are for one to three years of graduate study and research in coal-mining engineering.

One fellowship is offered annually by Olin Industries, Inc., to a third-year graduate student in metallurgical engineering for research in titanium and its alloys. It is awarded with a stipend of $1,500 on recommendation of the head of the Department of Mining and Metallurgical Engineering.

Graduate Teaching Faculty

Professors: H. L. Walker (Head of Department), W. R. Chedsey.
Associate Professor: E. J. Eckel.
Assistant Professors: W. H. Bruckner, H. Czyzewski, A. C. Forsyth, B. G. Ricketts.

MINING ENGINEERING

Courses for Graduates

401. Advanced Mineral Dressing and Coal Preparation. Advanced theory and practice of mineral dressing and coal preparation processes. I or II; 1 unit. Mr. Chedsey.

402. Mine Valuation, Taxation, and Mineral Economics. A study of current methods of evaluating mine properties; methods of taxation of mine prop-

erties and mineral reserves; and the relation of mineral resources to economics of society. I or II; 1 unit. Mr. Chedsey.

403. Advanced Mine Administration. Current methods and systems of mine administration in use by major mining corporations. I or II; 1 unit. Mr Chedsey.

491. Research in Mining Engineering and Mineral Dressing. Individual research in some phase of the general field of mining engineering and under the supervision of a member of the staff. Results of research may be used for graduate thesis. I, II; ½ to 4 units. Mr. Chedsey.

492. Research in Mining Engineering and Mineral Dressing. Individual research in some phase of the general field of mining engineering and under the supervision of a member of the staff. Results of research may be used for graduate thesis. I, II; ½ to 4 units. Mr. Chedsey.

Courses for Graduates and Advanced Undergraduates

302. World Mineral Economics. The role of minerals in a productive economy; the interdependence of minerals in industrial society and the problems arising out of their unequal geographic distribution and divided political control. II; 3 hours, or ¾ to 1 unit. Prerequisite: Senior standing. Open to all students in the University. Mr. Voskuil.

351. Geophysics of Mining. Same as Geology 351. Principles of geophysics and their application to mining processes. I; 3 hours, or 1 unit. Prerequisite: Senior standing in engineering or geology, or consent of instructor. Mr. Chedsey.

396. Seminar. Review of mining literature; reports; technical writing. II; 1 hour, or ¼ unit. Prerequisite: Senior standing. Mr. Chedsey.

METALLURGICAL ENGINEERING

Courses for Graduates

401. Advanced Physical Metallurgy. Fundamentals of ternary systems, ferrous metallurgical design, and gases in metals. I or II; 1 unit. Prerequisite: Equivalent of the undergraduate courses required in metallurgical engineering. Mr. Eckel.

402. Advanced Metallographic Technique. Advanced study of metallographic laboratory procedure. II; 1 unit. Prerequisite: Graduate standing in metallurgical engineering. Mr. Ricketts.

403. Tool Steels and Related Alloys. The course includes the metallurgical considerations related to the melting, casting, working, heat treatment, and inspection of the various classes and types of tool, die, and related complex alloy steels. I; 1 unit. Prerequisite: Graduate standing in metallurgical engineering. Mr. Forsyth.

404. Stainless Steels and High Temperature Alloys. Classification of stainless steels into three major classes: martensitic, ferritic, and austenitic. A detailed study is made of each class. The high temperature alloys are con-

veniently studied in four groups namely, iron base, nickel base, cobalt base, and miscellaneous in which molybdenum plays an important role. II; 1 unit. Prerequisite: Graduate standing in metallurgical engineering. Mr. Forsyth.

491. Research. Individual research in specialized problems and under supervision of members of staff. Results of research may be used for graduate thesis. I, II; ½ to 4 units. Staff.

492. Research. Individual research in specialized problems and under supervision of members of staff. Results of research may be used for graduate thesis. I, II; ½ to 4 units. Staff.

498. Seminar. Review of current research literature and departmental research program. Graduate students will present thesis research. Required of all graduate students in metallurgical engineering. I; no credit.

499. Seminar. Review of current research literature and departmental research program. Graduate students will present thesis research. Required of all graduate students in metallurgical engineering. II; no credit.

Courses for Graduates and Advanced Undergraduates

301. Metallurgy of Welding. A survey is made of existing welding procedures and their metallurgical (ferrous and non-ferrous) consequences with respect to the weld and base metal involved thermally in the welding operations. Heat flow in metals, arc behavior, slag behavior, and the physical metallurgy of heat-affected base metal are considered. Engineering phases of welding covered are economics of welding in relation to other methods of joining metals or producing engineering structures, thermal stresses, specification of materials for weld and base metal, and methods of production by means of welding and gas cutting. I or II; 3 hours, or ¾ or 1 unit. Prerequisite: Senior standing in metallurgical engineering; Metallurgical Engineering 208 and 210. Mr. Bruckner.

302. Powder Metallurgy. Production of powder metals; fabrication of metal shapes from powder metals; compacting, sintering, testing, and application of powdered metal shapes. II; 2 hours, or ¾ or 1 unit. Prerequisite: Approval of department; registration in Metallurgical Engineering 304; senior standing. Mr. Eckel.

304. Powder Metallurgy Laboratory. Experiments involving the testing, briquetting, sintering, repressing of metal powders, and the testing of sintered compacts. II; 1 hour, or ¼ unit. Prerequisite: Approval of department; registration in Metallurgical Engineering 302; senior standing. Mr. Eckel.

305. Metallurgy of Steel Casting. Technical and metallurgical control in the production of steel castings; acid and basic furnace practices; control of slag in steel making; heat treatment and metallography of steel castings. I, II; 3 hours, or ¾ or 1 unit. Prerequisite: Metallurgical Engineering 205, 208, and 210. Mr. Czyzewski.

306. Physics of Metals. The physical form of alloys; elastic and plastic behavior; creep, internal friction; failure phenomena; diffusion; modern metal physics concepts; electron theory of metals. I or II; 3 hours, or ¾ or 1 unit. Prerequisite: Senior standing in metallurgical engineering. Mr. Czyzewski.

308. Metallurgical Kinetics and Thermodynamics. Fundamental thermodynamic considerations and application of thermodynamics to metallurgical problems. II; 3 hours, or ¾ unit. Prerequisite: Senior standing; Chemistry 246. Offered in 1949-1950 and in alternate years.

MUSIC

An applicant for admission to graduate study in music is required: (1) to have finished successfully a four-year undergraduate curriculum in music or music education, or their equivalent in hours and content, from an institution which holds membership in, or is listed by, the Association of American Universities, or from a liberal arts college recognized by the North Central Association or equivalent regional accrediting association; and (2) to pass a qualifying examination in the major field of concentration to be administered by the Graduate Committee of the School of Music. If the major is to be applied music or music literature, this examination is essentially one of performance and is given at specified times during the year. If the major is to be musicology, theory, composition, music education, or band and orchestra conducting, applicants must present evidence to the committee of their ability to pursue work on the graduate level.

An applicant who holds a bachelor's degree from an independent conservatory or school of music will be considered under the following conditions. (1) The degree must be based on a four-year curriculum in music. (2) The undergraduate work presented for the degree of Bachelor of Music, or its equivalent, must include not less than fourteen hours in academic subjects, with not less than the equivalent of two years of college work in foreign languages, one year of which must be in French, German, or Italian. For the degree of Bachelor of Science in Music Education, or its equivalent, the academic and education courses taken must meet the requirements of the Illinois State Certificating Law for Teachers. (3) The applicant must pass a qualifying examination as explained above.

The School of Music offers degrees of Master of Music and of Master of Science in Music Education. For the degree of Master of Music, the major field may be in musicology, music theory and composition, music literature, applied music (organ, voice, piano, violin, cello), or band and orchestra conducting. For the field of musicology, a reading knowledge of both German and French is desirable.

Candidates for the degree of Master of Science in Music Education must earn four units in music, three of which are electives, two units in education, and two units in electives. Requirements are Music 427, 1 unit; music electives, 3 units; Education 400, Philosophy of Education, or Education 302, History of American Education, 1 unit; and Education 409, Advanced Educational Psychology, 1 unit. The electives must be selected with the approval of the advisor. Three electives must be in music, and the other two in music, in education, or, in exceptional cases, in other fields.

Graduate Teaching Faculty

Professors: J. M. Kuypers (Director of the School of Music), B. R. Foote, W. G. Hill, H. Kessler, R. H. Miles, S. Schoonmaker.

Associate Professors: D. A. Branigan, A. D. Etler, S. Fletcher, B. M. Goodman, M. H. Hindsley, P. Rolland, W. L. Roosa, H. C. C. Schmitt, R. H. Swenson, G. Waller, Jane C. Watt, E. Weigel, Velma K. Wilson.

Assistant Professors: Dorothy E. Bowen, Beth Bradley, L. R. Hamp, K. Kellogg, J. R. Kelly, P. S. Pettinga, L. A. Potter, J. W. Schiller, H. O. Sexton, Miriam Stewart, Edith Usry, Grace E. Wilson, L. E. Zirner.

Instructors: A. M. Carter, Phyllis Edwards, M. C. Howe, A. J. McDowell, L. A. Starr.

Assistants: Joanne Gill, Mary F. James, W. E. Jobusch.

Courses for Graduates

406. Advanced Theory and Composition. Advanced study of contrapuntal forms; study of contemporary melodic and harmonic practices; original work in advanced composition. I, II; ½ to 1½ units. Theory and Composition Faculty.

410. Advanced Instrumentation. Orchestrate for chamber and symphony orchestras, works of classical, romantic, and modern composers. I; ½ to 1 unit. Prerequisite: Undergraduate instrumentation. Mr. Kelly.

411. Advanced Instrumentation. Arrange for the concert band works from orchestra, organ, and chamber music by composers of the classical, romantic, and modern periods. II; ½ to 1 unit. Prerequisite: Undergraduate instrumentation. Mr. Hindsley.

414. Advanced Instrumental Conducting, Administration, and Literature. I; 1 to 1½ units. Prerequisite: Bachelor's degree, with major work or experience in band and/or orchestra; consent of instructor. Mr. Hindsley.

415. Advanced Instrumental Conducting, Administration, and Literature. II; 1 to 1½ units. Prerequisite: Bachelor's degree, with major work or experience in band and/or orchestra; consent of instructor. Mr. Hindsley.

416. Advanced Choral Conducting, Literature, and Administration. Deals with the training and conducting of choral groups. Special emphasis on the musical and organizational problems of various type groups including preparation of a critical bibliography of materials available in the choral repertory. I or II; 1 unit. Prerequisite: Graduate standing in music.

427. Administration and Supervision of Music Education. II; 1 unit. Prerequisite; Bachelor of Science degree in music education or in education with a music major, or Bachelor of Music degree, including music education courses. Mrs. V. Wilson.

430. Instrumental Music of the Eighteenth Century. I; 1 unit. Offered in 1949-1950 and in alternate years. Mr. Hill.

431. The Sonata. II; 1 unit. Offered in 1949-1950 and in alternate years. Mr. Hill.

432. Beethoven. I; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Hill.

433. Beethoven. II; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Hill.

436. Johann Sebastian Bach. The life and times of Johann Sebastian Bach, with a critical and analytical study of selected groups of representative works from all fields of his creative activity. I; 1 unit. Prerequisite: Representative theory and history courses required for the Bachelor of Music degree. Mr. Miles.

437. Johann Sebastian Bach. The life and times of Johann Sebastian Bach, with a critical and analytical study of selected groups of representative works from all fields of his creative activity. II; 1 unit. Prerequisite: Representative theory and history courses required for the Bachelor of Music degree. Mr. Miles.

460. Graduate Applied Music (Piano). I, II; 1½ units. Prerequisite: Bachelor of Music degree, and successful completion of a qualifying examination given by the graduate committee. Staff.

461. Graduate Applied Music (Voice). I, II; 1½ units. Prerequisite: Bachelor of Music degree, and successful completion of a qualifying examination given by the graduate committee. Staff.

462. Graduate Applied Music (Organ). Selected studies from the masterworks of organ literature. I, II; 1½ units. Prerequisite: Bachelor of Music degree, and successful completion of a qualifying examination given by the graduate committee. Staff.

463. Graduate Applied Music (Violin). I, II; 1½ units. Prerequisite: Bachelor of Music degree, and successful completion of a qualifying examination given by the graduate committee. Staff.

464. Graduate Applied Music (Cello). I, II; 1½ units. Prerequisite: Bachelor of Music degree, and successful completion of a qualifying examination given by the graduate committee. Staff.

480. Piano Literature. I; 1 to 1½ units. Mr. Kessler.

481. Piano Literature. II; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education degree, and qualifying examination given by the graduate committee. Mr. Kessler.

482. Vocal Literature. Study of solo song in larger works. I; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education degree, and qualifying examination given by the graduate committee. Mr. Kellogg.

483. Vocal Literature. Study of solo art song. II; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education degree, and qualifying examination given by the graduate committee. Mr. Kellogg.

484. Organ Literature. An intensive study of organ literature to the time of Bach. The material includes the music itself, recordings, and collateral readings. I; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of

Science in Music Education degree, and qualifying examination given by the graduate committee. Mr. Miles.

485. Organ Literature. An intensive study of organ literature from Bach to the present. The material includes the music itself, recordings, and collateral readings. II; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education degree, and qualifying examination given by the graduate committee. Mr. Miles.

486. String Instruments Literature. I; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education degree, and qualifying examination given by the graduate committee. Mr. Roosa.

487. String Instruments Literature. II; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education degree, and qualifying examination given by the graduate committee. Mr. Roosa.

491. Research in Special Fields. Research in particular subjects in the fields of music history and theory. I; 1 unit. Mr. Branigan, Mr. Hill, Mr. Hindsley, Mr. Kessler, Mr. Kuypers, Mr. Miles, Mrs. V. Wilson.

492. Research in Special Fields. Research in particular subjects in the fields of music history and theory. II; 1 unit. Mr. Branigan, Mr. Hill, Mr. Hindsley, Mr. Kessler, Mr. Kuypers, Mr. Miles, Mrs. V. Wilson.

Courses for Graduates and Advanced Undergraduates

300. Theory of Music — Advanced Harmony. Advanced harmony; altered chords; notation and harmonization of the chromatic scale; chromatic modulation; enharmonic transformations; use of inharmonic tones; harmonic analysis. I; 2 hours, or ¼ unit. Prerequisite: Music 107. Mr. Potter.

301. Theory of Music — Advanced Harmony. Advanced harmony: altered chords; notation and harmonization of the chromatic scale; chromatic modulation; enharmonic transformations; use of inharmonic tones; harmonic analysis. I, II; 2 hours, or ¼ unit. Prerequisite: Music 300. Mr. Potter.

302. Theory of Music — Free Counterpoint. Creative writing in linear counterpoint of the following: rounds, instrumental and vocal; canons; inventions; and fugues. Analysis of Bach inventions and well-tempered clavichord. I; 2 hours, or ½ unit. Prerequisite: Music 301. Mr. Kelly.

303. Theory of Music — Free Counterpoint. Creative writing in linear counterpoint of the following: rounds, instrumental and vocal; canons; inventions; and fugues. Analysis of Bach inventions and well-tempered clavichord. II; 2 hours, or ½ unit. Prerequisite: Music 302. Mr. Kelly.

306. Composition. Work in original composition including the study of fugue, canon, and of the small and large homophonic forms. I, II; 3 or 5 hours, or ½ to 1 unit. Five hours or 1 unit of credit given when the course is taken as major subject involving the preparation of a recital program of original compositions. Prerequisite: Music 107, or consent of instructor. This course may be taken in successive semesters for up to thirty hours credit. Theory and Composition Faculty.

314. Analysis of Musical Form. An elementary, systematic survey of the principles and means employed in musical composition. I; 2 hours, or ¼ unit. Prerequisite: Music 107; junior standing. Mr. Hill.

315. Analysis of Musical Form. A continuation of Music 314. II; 2 hours, or ¼ unit. Prerequisite: Music 314. Mr. Hill.

316. Teaching of Theory and Harmony. Techniques and materials used in the teaching of theory of music in senior high school and junior college. I, II; 2 hours, or ½ unit. Prerequisite: Music 300, or consent of instructor. Mr. Carter.

320. Advanced History of Music. I; 2 hours, or ¼ unit. Prerequisite: Music 226 and 227. Mr. Hill.

321. Advanced History of Music. II; 2 hours, or ¼ unit. Prerequisite: Music 320. Mr. Hill.

324. The Music Dramas of Richard Wagner. Trends in opera at the time of Richard Wagner. His influence on opera composition and development of his own style. I; 2 hours, or ½ unit. Prerequisite: Music 110 and 114, or 117, or junior standing in music, or consent of instructor. Mr. Schiller.

325. The Music Dramas of Richard Wagner. Trends in opera at the time of Richard Wagner. His influence on opera composition and development of his own style. II; 2 hours, or ½ unit. Prerequisite: Music 110 and 114, or 117, or junior standing in music, or consent of instructor. Mr. Schiller.

330. Instrumental Clinic. Application of principles and techniques taught in previous music education courses. I; 2 hours, or ½ unit. Prerequisite: Music 217, 220, 221, or consent of instructor. Staff.

331. Instrumental Clinic. Application of principles and techniques taught in previous music education courses. II; 2 hours, or ½ unit. Prerequisite: Music 217, 220, 221, or consent of instructor. Staff.

334. Methods of String Class Teaching. This course is designed primarily for teachers of school music who are not performers on a stringed instrument yet would like to be able to teach string classes and start an orchestral program in the schools. S; 2 hours, or ½ unit. Prerequisite: Senior standing in music education, or consent of instructor. Mr. Waller.

APPLIED MUSIC

Courses for Graduates and Advanced Undergraduates

360. Piano. Private lessons in piano on the advanced undergraduate and graduate level. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 160; qualifying examination for transfer students. Miss Bradley, Mr. Branigan, Miss Edwards, Mr. Fletcher, Mr. Schoonmaker, Miss Usry, Miss Watt, Mr. Zirner.

361. Voice. Private lessons in singing on the advanced undergraduate and graduate level. I, II; 2 or 3 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 161; qualifying examination for transfer students. Miss Bowen, Mr. Foote, Mr. Hamp, Mr. Kellogg, Mrs. Stewart, Miss G. Wilson.

362. Organ. A repertoire course, using graded material, culminating in performance of the masterpieces of Bach, Franck, and Rheinberger; and selected works from the pre-Bach and contemporary periods. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 162; qualifying examination for transfer students. Mr. Miles, Mr. Pettinga.

363. Violin. Private instruction in violin on the advanced undergraduate and graduate level. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 163; qualifying examination for transfer students. Mr. Goodman, Mr. Rolland, Mr. Schmitt.

364. Viola. Private instruction in viola on the advanced undergraduate and graduate level. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 164; qualifying examination for transfer students. Mr. Garvey.

365. Cello. Private instruction in cello on the advanced undergraduate and graduate level. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 165; qualifying examination for transfer students. Mr. Potter, Mr. Swenson.

366. String Bass. Tuning by harmonics. Development of flexibility in bowing. Development of a practical working knowledge of the first six positions; also thumb positions. Major and minor scales through higher positions. String ensemble and orchestra studies; solo repertoire and studies. Study of various bowing styles. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 166; qualifying examination for transfer students. Miss Edwards.

367. Flute. Private lessons in flute on the advanced undergraduate and graduate level. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 167; qualifying examination for transfer students. Miss James.

368. Clarinet. Private lessons in clarinet on the advanced undergraduate and graduate level. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 168; qualifying examination for transfer students. Mr. McDowell.

369. Oboe. Private lessons in oboe on the advanced undergraduate and graduate level. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 169; qualifying examination for transfer students. Miss James.

370. Bassoon. Private lessons in bassoon on the advanced undergraduate and graduate level. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 170; qualifying examination for transfer students. Miss James.

371. Cornet and Trumpet. Private instruction in cornet and trumpet on the advanced undergraduate and graduate level. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 171; qualifying examination for transfer students. Mr. Sexton.

372. French Horn. Private instruction in French horn on the advanced undergraduate and graduate level. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2

hours, or ¼ unit. Prerequisite: Music 172; qualifying examination for transfer students. Mr. Howe.

373. Trombone. Private instruction in trombone on the advanced undergraduate and graduate level. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 173; qualifying examination for transfer students. Mr. Starr.

374. Baritone. Private instruction in baritone on the advanced undergraduate and graduate level. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 174; qualifying examination for transfer students. Mr. Starr.

375. Tuba. Private instruction in tuba on the advanced undergraduate and graduate level. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 175; qualifying examination for transfer students. Mr. Starr.

376. Percussion. Private instruction in percussion on the advanced undergraduate and graduate level. I, II; 2 to 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Music 176; qualifying examination for transfer students.

377. Harp. Private lessons for advanced undergraduates and graduates in harp. I, II; 2 or 4 hours, or ¼ to 1 unit. S; 1 to 2 hours, or ¼ unit. Prerequisite: Qualifying examination in harp, or Music 177. Miss Gill.

380. French Diction. Principles of French pronunciation applied to French vocal literature. Class and individual clinical analysis and practice. I; 1 hour, or ¼ unit. Prerequisite: Junior standing. Miss Bowen.

381. French Diction. Principles of French pronunciation applied to French vocal literature. Class and individual clinical analysis and practice. II; 1 hour, or ¼ unit. Prerequisite: Music 380; junior standing, or consent of instructor. Miss Bowen.

382. Senior Diction. Preparation for senior recital; review of English, French, Italian, and German diction; stage deportment. I; 1 hour, or ¼ unit. Prerequisite: Senior standing. Miss Bowen.

383. Senior Diction. Preparation for senior recital; review of English, French, Italian, and German diction; stage deportment. II; 1 hour, or ¼ unit. Prerequisite: Music 382; senior standing, or consent of instructor. Miss Bowen.

PHILOSOPHY

The Department of Philosophy offers graduate work leading to the Master of Arts and Doctor of Philosophy degrees.

Students beginning graduate work with philosophy as their major subject should have had a course in logic, a course in ethics, and a general course in the history of philosophy. Students with deficiencies may be required to fill them by taking Philosophy 102 (or 333), 321, or 303 and 304, respectively, in addition to the minimum requirement of eight units for the master's degree.

The following statements are supplementary to the general rules of the Graduate College.

Degree of Master of Arts. A candidate for this degree must choose at least one course in each of the following fields: history of philosophy; theory of knowledge, including logic and philosophy of science; and theory of value, including ethics and esthetics. In addition to completing eight units of graduate work, the candidate must take an oral examination on the work represented by these units. His advisor will arrange and preside at this examination. The thesis requirement will be waived only on recommendation of the advisor and approval by the department.

Degree of Doctor of Philosophy. Candidates for this degree must choose at least two courses in each of the following fields: history of philosophy, theory of knowledge, and theory of value.

Major subjects may be chosen from the following: (1) history of philosophy; (2) theory of knowledge, including logic and philosophy of science; (3) theory of value, including ethics, social philosophy, and esthetics.

Minor subjects may be chosen from the above or may be more restricted in scope: e.g., metaphysics, philosophy of law, any subtopic in (2) or (3) above, or a shorter period or particular movement in the history of philosophy. In general, however, the department recommends a single minor outside the department rather than two minors, one within and one outside. The candidate's choice of minor or minors must be approved by the department on recommendation of the advisor.

The preliminary examination for the doctor's degree, in addition to the major and minor subjects, will presuppose first-hand acquaintance with at least one major work of Plato, Aristotle, Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume, Kant, and Hegel, and such an acquaintance with the history of philosophy in general as may be obtained from a standard textbook history.

Graduate Teaching Faculty

Professors: M. T. McClure (Head of Department), M. H. Fisch, D. W. Gotshalk, S. C. Pepper (Visiting).

Associate Professors: J. A. Nicholson, A. R. Turquette, F. L. Will.

Assistant Professor: B. J. Diggs.

Courses for Graduates

401. Seminar in Ancient Philosophy. Topic: Post-Aristotelian Greek and Roman Philosophy. I; 1 unit. Mr. McClure.

402. Seminar in Ancient Philosophy. Topic: Aristotle. II; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Fisch.

405. Seventeenth Century Continental Thought (Descartes, Spinoza, Leibniz). A study of the basic philosophical works of the three leading continental thinkers of the century. I; 1 unit. Mr. Gotshalk.

407. British Empiricism (Hobbes, Locke). I or II; 1 unit. Offered in 1949-1950 and in alternate years. Mr. Gotshalk.

408. German Idealism (Kant). II; 1 unit. Mr. McClure.

409. Recent American Philosophy. Major American philosophers and movements since about 1900. I; 1 unit. Offered in 1949-1950 and in alternate years. Mr. Fisch.

411. Recent Ethical Theory. I; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Fisch.

413. Logical Theory. Logical syntax and semantics. II; 1 unit. Prerequisite: A course in logic, or consent of instructor. Mr. Turquette.

421. Seminar in Contemporary Problems. Intensive study of selected problems on topics in contemporary philosophy, with particular emphasis on questions of knowledge and value. I; 1 unit. Mr. Will.

422. Seminar in Contemporary Problems. Intensive study of selected problems on topics in contemporary philosophy, with particular emphasis on questions of knowledge and value. II; 1 unit. Mr. Fisch.

480. Theory of Value. II; 1 unit. Offered in 1948-1949. Mr. Pepper.

493. Research. Research in special topics. I; ½ to 2 units. Staff.

494. Research. Research in special topics. II; ½ to 2 units. Staff.

Courses for Graduates and Advanced Undergraduates

303. History of Greek and Roman Philosophy. I; 4 hours, or ½ to 1 unit. Prerequisite: Junior standing, or consent of instructor. Mr. Easterling, Mr. Linsky, Mr. Martin, Mr. McClure, Mr. Tiebout.

304. History of Medieval Philosophy. Lectures and readings in the history of philosophy from St. Augustine to William of Ockham. II; 3 hours, or ½ to 1 unit. Prerequisite: Philosophy 101 or 303, or consent of instructor; junior standing. Mr. Diggs.

306. History of Modern Philosophy. II; 4 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Easterling, Mr. Linsky, Mr. Martin, Mr. McClure, Mr. Tiebout.

309. The Philosophy of Plato. I; 3 hours, or ½ to 1 unit. Prerequisite: Philosophy 101 or 303; junior standing.

311. Philosophical Ideas: Rousseau to Bergson. II; 3 hours, or ½ to 1 unit. Prerequisite: One course in philosophy; junior standing. Mr. Fisch.

313. American Philosophy. The history of philosophy in America from colonial times to the present. I; 3 hours, or ½ to 1 unit. Prerequisite: One course in philosophy; junior standing. Mr. Fisch.

316. Three Philosophical Poems. Lucretius, *Of the Nature of Things;* Dante, *Divine Comedy;* Goethe, *Faust;* studied as literary expressions of three major movements in European thought: Greek naturalism, medieval supernaturalism, and modern romanticism. I; 3 hours, or ½ to 1 unit. Prerequisite: Philosophy 101, or consent of instructor. Offered in 1949-1950 and in alternate years. Mr. Fisch.

317. Great Books in Modern Thought. Reading and discussion of selected books which either have produced or themselves reflect in some important way a changed conception of man and the world. I; 3 hours, or ½ to 1 unit. Prerequisite: One course in philosophy, junior standing. Mr. Will.

321. Ethics and Value Theory. I; 3 hours, or ½ to 1 unit. Prerequisite: One course in philosophy; junior standing. Mr. Fisch.

323. Philosophy of Art. A discussion of the main philosophical principles of art, and of outstanding contemporary philosophies of art. I; 3 hours, or ½ to 1 unit. Prerequisite: One course in philosophy, or Division of General Studies 161 or 162; junior standing. Mr. Gotshalk.

324. Philosophy of Religion. II; 3 hours, or ½ to 1 unit. Prerequisite: One course in philosophy; junior standing. Mr. Nicholson.

326. Metaphysics. II; 3 hours, or ½ to 1 unit. Prerequisite: One course in philosophy; junior standing.

328. Philosophy of Science. A study of some philosophical problems that have developed from modern science. II; 3 hours, or ½ to 1 unit. Prerequisite: One course in philosophy; junior standing. Mr. Turquette.

330. Theory of Knowledge. The relative acceptability of authority, intuition, and the method of hypothesis as ways of establishing belief; logical and empirical truth; pragmatism and positivism; other selected contemporary topics. II; 3 hours, or ½ to 1 unit. Prerequisite: One course in philosophy; junior standing. Mr. Will.

333. Symbolic Logic. A study of the elementary principles of symbolic analysis as applied to logical problems. I; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Turquette.

334. Symbolic Logic. A general study of the more refined methods of symbolic analysis as applied to logical problems. Particular attention is devoted to proof procedures as they relate to the question of consistency and completeness. II; 3 hours, or ½ to 1 unit. Prerequisite: Philosophy 333, or consent of instructor. Offered in 1948-1949 and in alternate years. Mr. Turquette.

336. Philosophy of Law and of the State. II; 3 hours, or ½ to 1 unit. Prerequisite: One course in philosophy; junior standing. Mr. Fisch.

337. Semantics. An investigation of semantical concepts such as denoting and truth. A study of the functions of language, definition, meaning and verification, semantical paradoxes. I; 3 hours, or ½ to 1 unit. Prerequisite: One course in philosophy.

390. Aesthetics. II; 3 hours, or ½ unit. Prerequisite: One course in philosophy; junior standing. Mr. Pepper.

PHYSICAL EDUCATION

The department offers graduate work leading to the Master of Science and Doctor of Philosophy degrees.

Master of Science in Physical Education. The graduate program leading to this degree offers two options. Option 1 is for students who propose to specialize in the areas of physical education, sports, health, safety, physical fitness, rehabilitation, recreation, and camping. Option 2 is for students who propose to teach and/or administer these programs in the elementary school, high school, and junior college.

For Option 1 the admission requirements are thirty hours of approved undergraduate credit in physical education. Candidates with experience in physical education may receive credit toward admission up to a maximum of eight hours; eighteen hours of credit in approved undergraduate work in science; a course in the theory of tests and measurements or a course in the theory of statistics. For Option 2, in addition to the above, sixteen hours of approved undergraduate credit in education are required.

The graduation requirements for Option 1 are eight units (two full semesters work or equivalent) to include: (a) credit in physical education courses, 4 units; (b) credit in physical education courses or in a related field as approved by advisor, 2 units; (c) registration in and satisfactory completion of Physical Education 490 for one semester, no credit; (d) presentation of an acceptable thesis, 2 units. Candidates may petition to waive the thesis requirement. Those who are excused are required to secure two units credit in lieu of thesis credit and in addition are required to take and pass a final comprehensive examination (oral or written) in physical education. Graduation requirements for Option 2 are the same as above, except that two units of graduate credit in education (Education 409, Advanced Educational Psychology, plus one other approved course) must be substituted for (b). The advisor for candidates for this degree is Director S. C. Staley, 108 Huff Gymnasium.

Doctor of Philosophy in Physical Education. Admission requirements for this degree are thirty hours of approved undergraduate credit in physical education. Candidates with experience in physical education may receive credit toward admission up to a maximum of eight hours; eighteen hours of approved undergraduate credit in science; a course in the theory of tests and measurements or a course in the theory of statistics.

The requirements for graduation are twenty-four units of graduate credit (six full semesters work or equivalent) to include: (a) a minimum of 8 units credit in physical education courses; (b) one minor for a minimum of 4 units (or two minors for a minimum of 2 units each); (c) registration in and satisfactory completion of Physical Education 490 for one semester; (d) presentation of an acceptable thesis for 8 units.

Language Examination. Each candidate must pass a reading examination in French and German. No student will be considered as beginning his second year of graduate work until he has passed one of these examinations. Both examinations must be passed before taking the preliminary examination.

Each candidate must pass a combined written and oral examination covering his major and minor fields of study. This preliminary examination will be given toward the end of the second year of study, or, by special permission, at the beginning of the third year (not later than November 1).

Each candidate must pass a final examination, principally on his thesis. This examination must be taken at least two weeks before the degree is to be conferred.

Graduate Teaching Faculty

Professors: S. C. Staley (Director of the School of Physical Education), T. K. Cureton, G. T. Stafford.

Associate Professor: C. O. Jackson.

Courses for Graduates

(Open to both men and women)

400. Problems in Public Health. This course is designed to provide graduate students with the basic information and fundamental principles underlying intelligent efforts of health promotion and to develop an attitude, perspective, and philosophy in dealing with health programs to insure to a high degree the correct appraisal of their value. S; 1 unit.

401. Problems in Physical Education. Deals with problems involved in organizing and conducting the program in physical education; biological, physiological, psychological, and social implications of physical education; selection and distribution of activities; teaching methods; facilities; time allotment; teacher preparation; professional advancement; etc. I or II; 1 unit. Mr. Jackson, Mr. Staley.

402. Problems in Safety Education. Philosophy of safety; traffic, recreation, home, and industrial safety facts and figures; the safety problem and its relation to education; organization and administration of safety education; preparation of teaching personnel; methods of teaching; legal aspects; research problems. I or II; 1 unit. Mr. Stafford.

403. Problems in Health Education. Health service, including health examinations, correction of defects, control of communicable disease; healthful school environment; mental health; organization of school health programs in elementary and secondary schools; instruction in health; teaching methods; evaluation. I or II; 1 unit. Mr. Stafford.

404. Problems in Recreation. Deals with the history, scope, function, and organization of public and private recreation. Covers national, state, county, municipal, and rural programs; legal status, financing, administration. I or II; 1 unit.

406. Philosophy of Sport. Reviews the field of sport in terms of cultural, social, hygienic, national, educational, character, therapeutic, personality, military, and other outcomes and values. I or II; 1 unit. Mr. Staley.

407. Sports Psychology. A consideration of some of the processes by which patterns of behavior important in physical education and sports are formed. Some reference to health education and recreation will be made. I or II; 1 unit. Prerequisite: Psychology 100; Education 109 and 409; consent of instructor.

450. Trends and Techniques in Rehabilitation. Philosophy of rehabilitation; problems in the education of the handicapped (blind and partially sighted, deaf and hard of hearing, the educable mentally handicapped, the socially maladjusted, orthopedic crippled, cardiac, epileptic, speech deviate, etc.); state and federal plans for education and vocational training of handicapped children and adults; community rehabilitation centers; training of teachers of the handicapped. I or II; 1 unit. Mr. Stafford.

451. Scientific Foundations of Physical Fitness. Scientific basis and contemporary developments of educational programs in physical fitness; programs of governmental and private organizations; analysis of physical fitness tests;

methods and techniques used in physical fitness testing and remedial clinics. I or II; 1 unit. Prerequisite: Undergraduate anatomy and physiology, tests and measurements. Mr. Cureton.

452. Scientific Analysis of Physical Education Activities. Analysis of a selected number of physical education activities by the application of principles and methods of advanced physiology of exercise, mechanics and kinesiology, reducing the movements to physical equations or the scientific laws which apply. I or II; 1 unit. Prerequisite: Anatomy, kinesiology, elementary physics, algebra, trigonometry, and physiology. Mr. Cureton.

490. Seminar. Lectures, discussions, and critiques on physical education, physical fitness, sports, health, safety, recreation, camping, and related subjects by faculty members and visiting professional leaders. Presentation of theses by students. I, II; no credit. Mr. Cureton, Mr. Stafford, Mr. Staley.

491. Thesis. Open only to students engaged in preparing theses. Amount of credit will be adapted to each individual's case. I; ½ to 4 units. Mr. Cureton, Mr. Jackson, Mr. Stafford, Mr. Staley.

492. Thesis. Open only to students engaged in preparing theses. Amount of credit will be adapted to each individual's case. II; ½ to 4 units. Mr. Cureton, Mr. Jackson, Mr. Stafford, Mr. Staley.

493. Research. Independent research in special projects. Open only to students working toward doctor's degree. I; ½ to 2 units. Mr. Cureton, Mr. Stafford, Mr. Staley.

494. Research. Independent research in special projects. Open only to students working toward doctor's degree. II; ½ to 2 units. Mr. Cureton, Mr. Stafford, Mr. Staley.

495. Techniques of Research in Health, Physical Education, and Recreation. Review and appraisal of the more common research procedures and literature in the health, physical education, and recreation field. Attention will be given to applications of statistical procedures, library methods, survey procedures, evaluation procedures, and experimental methods. I or II; 1 unit. Prerequisite: Graduate standing in physical education. Mr. Cureton.

PHYSICAL SCIENCES

A special program leading to the degree of Master of Science in the Physical Sciences is available to meet the needs of students who wish to study in both chemistry and physics rather than to specialize in one department. It is designed primarily for those preparing to teach the physical sciences. Students working toward a degree under the provisions of this program are expected to seek approximately equal proficiency in both physics and chemistry; those whose undergraduate work has emphasized chemistry should balance this by weighting the graduate work in favor of physics, and vice versa. No thesis is required, and all courses in physics and chemistry which normally give graduate credit will carry credit toward the degree. To qualify for the degree, a student must have had, or must include in his program, at least one course in mathematics beyond the calculus, and for which the calculus is a prerequisite.

Candidates for the degree of Master of Science in the Teaching of the Physical Sciences must earn four units in the physical sciences, two units in education, and two units in electives. Requirements are the physical sciences, 4 units; Education 400, Philosophy of Education, or Education 302, History of American Education, 1 unit; and Education 409, Advanced Educational Psychology, 1 unit. The courses in the physical sciences and the electives must be selected with the approval of the advisor. The electives may be in the physical sciences, in education, or, in exceptional cases, in other fields. The advisor for candidates for this degree is Professor J. C. Bailar, 109 Chemistry Annex.

PHYSICO-CHEMICAL BIOLOGY

Training for the degree of Doctor of Philosophy in Physico-Chemical Biology is administered by a committee of the Division of Biological Sciences. The chairman of this committee is Professor Robert Emerson, 157 Natural History Building. In this curriculum, courses in physics and chemistry are combined with training in the principles of general biology as illustrated by some group of organisms. Research facilities are available in cellular physiology, photosynthesis, electrophysiology, diffusion processes, and radiobiology.

Minimal admission requirements are college biology (six hours), college physics (eight hours), analytical and organic chemistry, and calculus. All candidates are required to take the following or to show equivalent credits:

Chemistry: Chemistry 240, Physical Chemistry, and either 350, biochemistry, or 336 and 337, Organic Chemistry.

Physics: Two units from Physics 341 and 342, Electricity; 371, 372, 373, and 374, Light; 360, Heat; 381, Atomic Physics; 382, Nuclear Physics.

Cytology or Genetics: One unit from either Zoology 403, Cytology, or 351 and 352, Genetics, or Botany 320 or 322, Genetics, or Botany 420, 421, Cytogenetics.

Physiology: One unit from either Physiology 306 or 307, Mammalian Physiology; 341, Comparative Physiology; 342, Cellular Physiology; Botany 333, 335, or 433, Plant Physiology; or Entomology 324 or 325, Insect Physiology.

Advanced Biology: Two units from among the following courses: Zoology 333, Embryology; 320, Invertebrate Zoology; 318, Protozoology; 334, Histology; 322, Advanced Vertebrate Anatomy; Botany 304, General Morphology; 345, Plant Anatomy; 322, Heredity and Evolution; 372, Mycology; 471, Mycology of Special Groups; 340, Histology, Microtechnique; Bacteriology 320, General Bacteriology; 403, Physiology of Bacteria; Entomology 322, Insect Bionomics, or 407, Insect Anatomy.

Eight additional units are to be chosen from selected areas of biology, physics, chemistry, or mathematics.

The following graduate courses are intended to supplement this curriculum: Physiology 462, Advanced General Physiology; Zoology 455, Physiological Genetics; Botany 419, Photosynthesis and Related Subjects; Physics 351, 352, Biophysics.

PHYSICS

The Department of Physics offers graduate work leading to the Master of Science and Doctor of Philosophy degrees.

A year of calculus and a year of general physics, with laboratory, are prerequisite for all major and minor graduate work in physics. In addition, graduate students whose major is physics must have had at least twelve semester hours in more advanced courses in physics and mathematics, which must include a course in mechanics and one in electricity and magnetism. They should be able to use references in German.

Candidates for the degree of Master of Science in the Teaching of Physics must earn four units in physics, two units in education, and two units in electives. Requirements are physics, 4 units; Education 400, Philosophy of Education, or Education 302, History of American Education, 1 unit; and Education 409, Advanced Educational Psychology, 1 unit. The courses in physics and the electives must be selected with the approval of the advisor. The electives may be in physics, in education, or, in exceptional cases, in other fields. The advisor for candidates for this degree is Professor R. F. Paton, 200 Physics Laboratory.

Graduate Teaching Faculty

Professors: F. W. Loomis (Head of Department), G. M. Almy, J. H. Bartlett, S. M. Dancoff, M. Goldhaber, D. W. Kerst, P. G. Kruger, A. T. Nordsieck, L. N. Ridenour, F. Seitz.

Associate Professors: J. S. Allen, A. Longacre, E. M. Lyman, R. J. Maurer, R. F. Paton, H. Quastler, C. W. Sherwin.

Assistant Professors: G. D. Adams, R. A. Becker, R. B. Duffield, A. O. Hanson, R. D. Hill, H. W. Koch, W. E. Meyerhof, R. D. Rawcliffe, C. S. Robinson, G. F. Tape.

Courses for Graduates

400. Problems and Methods of Theoretical Physics. Vector analysis. Boundary value problems. The equations of mathematical physics; variational derivation; contour integration; ordinary differential equations; boundary conditions; Green's functions; Eigen functions; Laplace's and Poisson's equations in one, two, and three dimensions; conformal mapping; integral representation; asymptotic expansions. I; 1 unit. Prerequisite: Mathematics 342, or 345, or 347, or 387; Physics 322 and 342, or consent of instructor. Mr. Nordsieck.

403. Experimental Research Techniques. This course is intended to bridge the gap between the undergraduate laboratory work and actual research in experimental physics. The student is introduced to high vacuum techniques, to the elements of glass blowing and machine shop practice, and to advanced electronic circuits in the form of linear amplifiers, oscilloscopes, and control equipment. There are experiments on gaseous discharges, X-rays, electron diffraction, thermionics, the measurement of small currents and nuclear physics. There is opportunity for a student to select his problems and follow them as far as he wishes. I, II; 1 unit. Prerequisite: Physics 343 and 374; consent of instructor. Mr. Sherwin and others.

404. Experimental Research Techniques. Continuation of Physics 403. I, II; 1 unit. Prerequisite: Physics 403; consent of instructor. Mr. Sherwin and others.

422. Dynamics. Lagrange equations, Hamilton's principle; small vibrations; motion in a central field; Hamilton's canonical equations; least action; contact transformations; Lagrange and Poisson brackets; integral invariants; Hamilton-Jacobi equation; action and angle variables; perturbation theory; adiabatic invariants. II; 1 unit. Prerequisite: Physics 322; Mathematics 345. Mr. Nordsieck.

441. Electrodynamics. Electrostatics; Poisson's equations, Laplace's equations, boundary value problems, spherical harmonics, multipole potentials. Dielectrics: microscopic and macroscopic fields. Magnetostatics; vector potential, magnetic multipoles. Magnetic media: ferro-, dia-, para-magnetism. Conducting media. Maxwell's equations; field energy and momentum; retarded potentials. Fields due to moving charges: Lienard-Wiechert potential; fields of an accelerated charge. I; 1 unit. Prerequisite: Physics 342, or equivalent; registration in Physics 400, or consent of instructor. Mr. Nordsieck.

442. Electrodynamics. Continuation of Physics 441. Self force of a finite electron. Multipole radiation. Propagation of radiation in material media; wave guides; modes of propagation; skin effect. Special relativity. Lorentz-Abraham electron. II; 1 unit. Prerequisite: Physics 441. Mr. Dancoff.

463. Statistical Mechanics. Statistical ensembles. The Maxwell-Boltzmann law. Approach to equilibrium. Quantum statistical mechanics. Application of statistical mechanics to thermodynamic processes. I; 1 unit. Prerequisite: Physics 422; Physics 360 or 362.

481. Line Spectra and Atomic Spectra. A lecture course presenting Planck's law of radiation, the Bohr theory, de Broglie waves, and a brief introduction to wave mechanics. The course deals with the atomic nature of matter, elementary particles, the photoelectric effect, simple and complex atomic spectra, X-ray spectra, hyperfine structure, absorption, fluorescence, and ionization. I; 1 unit. Prerequisite: Physics 322, 342, and 372. Mr. Axel.

483. Nuclear Physics. Detection of nuclear radiations. Radioactive decay, natural radioactive isotopes, abundance of stable elements and stable isotopes. Rutherford scattering, interaction of nuclear radiations (excluding neutrons) with matter, nuclear transformations, nuclear masses. I; 1 unit. Prerequisite: Physics 481. Mr. Hill.

484. Nuclear Physics. Excited states of nuclei, fast and slow neutrons, magnetic moments of nuclei, nuclear forces, artificially produced radioactive isotopes, theory of beta-decay, resonance reactions, Bohr's drop model, fission. II; 1 unit. Prerequisite: Physics 483. Mr. Goldhaber.

485. Quantum Mechanics. Schrödinger wave equation; stationary state solutions. Operators and matrices. Perturbation theory; non-degenerate and degenerate cases. WKB approximation; radioactive decay, non-harmonic oscillator, etc. Collision problems: Born approximation, method of partial waves. I; 1 unit. Prerequisite: Physics 481, 422; Physics 400, or consent of instructor. Mr. Dancoff.

486. Quantum Mechanics. Time dependent perturbation theory; elastic and inelastic scattering, absorption of light, sudden perturbations, adiabatic perturbations. Wave functions for identical particles, quantum statistics. Pauli spin operator. Classification of atomic states. Thomas-Fermi model. Quantization of radiation field. Interaction of light with matter. Dirac electron theory; stationary state solutions, scattering, radiative effects; positron theory. II; 1 unit. Prerequisite: Physics 485. Mr. Dancoff.

487. Advanced Quantum Mechanics. Second quantization. Connection between spin and statistics. Fields of spin 0, ½, 1. Beta decay theory. Meson theory of nuclear forces. Convergence difficulties and recipes in quantum field theory. I; 1 unit. Prerequisite: Physics 486. Offered in alternate years; not offered in 1949-1950.

488. Advanced Quantum Mechanics. Continuation of Physics 487. II; 1 unit. Prerequisite: Physics 487. Offered in alternate years; not offered in 1949-1950.

493. Research. I, II; 1 to 4 units.

498. Seminar. A course number used when it is desirable to give credit for individual but supervised study of a subject not covered by regular courses. Most of the actual seminars in the department are organized entirely informally and without credit. I, II; 1 to 2 units.

Courses for Graduates and Advanced Undergraduates

321. Theoretical Mechanics. Lectures and problems. Physics 321 and 322 are fundamental to many advanced courses and should be elected as early as possible by those intending to specialize in physics. Laws of motion, vectors, statics, energy and momentum principles for a particle and for systems of particles, motion of a particle under constant forces, plane motion of a rigid body, simple harmonic motion and resonance, impact. I, II; 3 hours, or 1 unit. Prerequisite: General physics and calculus; registration in Mathematics 341, or 343, or consent of instructor. Mr. Becker.

322. Theoretical Mechanics. Continuation of Physics 321. Motion of a particle under a variable force, central field motion, accelerated reference systems, motion of a particle subject to constraints, rotation of a rigid body, dimensions, vibrating systems and normal coordinates, generalized coordinates. I, II; 3 hours, or 1 unit. Prerequisite: Physics 321, or equivalent; registration in Mathematics 342, or 345, or consent of instructor. Mr. Becker.

330. Sound. Lectures and problems. Fundamentals of wave motion as related to sound and vibration; propagation, reflection, refraction, interference, and diffraction of sound; production and properties of sound waves and musical tones. Some applications of sound theory; musical instruments, recording and reproduction; the ear, signalling devices, and architectural acoustics. II; 3 hours, or 1 unit. Prerequisite: General physics and calculus.

341. Electricity and Magnetism. Lectures, problems, and laboratory. This course is fundamental to advanced courses and should be elected as early as possible by those intending to specialize in physics. Electrostatics, dielectrics, D.C. circuits and instruments, thermionic emission. I; 3 hours, or

1 unit. Prerequisite: General physics and calculus; registration in Mathematics 341, or 343, or consent of instructor. Mr. Hanson and others.

342. Electricity and Magnetism. Continuation of Physics 341. Magnetic fields due to currents; self and mutual inductance; permeable media, hysteresis, para-, dia-, and ferro-magnetism; motion of charges in electric and magnetic fields; A.C. circuits, transmission lines; Maxwell's equations, electromagnetic waves, and radiation. II; 3 hours, or 1 unit. Prerequisite: Physics 341, or equivalent; registration in Mathematics 342, or 345, or consent of instructor. Mr. Hanson and others.

343. Vacuum Tube Circuits. Lectures, problems, and laboratory. Elementary theory and applications of vacuum tubes as linear circuit elements in amplifiers and electronic instruments. Emphasis on experimental techniques. II; 4 hours, or 1 unit. Prerequisite: Physics 341. Mr. Lyman and others.

344. Vacuum Tube Circuits. Continuation of Physics 343. Electronic instruments and techniques used in research in physics. Advanced theory and experiments emphasizing the use of vacuum tubes as non-linear circuit elements: multi-vibrators, blocking oscillators, pulse generators, and amplifiers; Geiger counter circuits, synchronizing and time-measuring circuits. Familiarization with instruments and techniques used in research in physics. I; 4 hours, or 1 unit. Prerequisite: Physics 343, or equivalent. Mr. Lyman and others.

351. Biophysics. Effect of light and ionizing radiations on living matter, including photosynthesis, phototropism, and vision. I; 3 hours, or 1 unit. Prerequisite: General physics and calculus; consent of instructor. Mr. Bartlett.

352. Biophysics. Continuation of Physics 351. II; 3 hours, or 1 unit. Prerequisite: Physics 351, or consent of instructor. Mr. Bartlett.

360. Heat. Lectures and recitations. Definition and measurement of thermodynamic functions such as temperature, entropy, enthalpy, etc.; heat conversion and transfer; equilibrium and cyclic phenomena; thermal radiation; energy exchanges at very low and very high temperatures. II; 3 hours, or 1 unit. Prerequisite: General physics and calculus. Mr. Snyder.

362. Kinetic Theory of Gases. A lecture and problem course presenting the theory of gases and treating such topics as the distribution law, viscosity, diffusion, thermal conduction, thermodynamic properties, and some of the fundamentals of the statistical method. I, II; 3 hours, or 1 unit. Prerequisite: General physics and calculus. Mr. Maurer.

371. Light. Lectures. Geometrical optics with emphasis on application to instruments, interference, and diffraction. I; 2 hours, or ½ unit. Prerequisite: General physics and calculus. Mr. Almy.

372. Light. Continuation of Physics 371. Electromagnetic character of light, Maxwell's equations, theory of reflection and refraction, polarization, double refraction, crystal optics, dispersion, scattering, optical properties of metals. II; 2 hours, or ½ unit. Prerequisite: Physics 371. Mr. Almy.

373. Light Laboratory. I; 2 hours, or ½ unit. Prerequisite: Registration in Physics 371. Mr. Almy and others.

374. Light Laboratory. Continuation of Physics 373. II; 2 hours, or ½ unit. Prerequisite: Registration in Physics 372. Mr. Almy and others.

381. Atomic Physics. A lecture and problem course presenting our modern knowledge of the several physical constants and of the nature and properties of atoms and atomic spectra, molecules and molecular spectra, electrons, light quanta, the photoelectric effect and the Compton effect. I; 3 hours, or 1 unit. Prerequisite: General physics and calculus. Mr. Kruger.

382. Nuclear Physics. A lecture and problem course presenting our modern knowledge of the properties of nuclear particles, natural and artificial radioactivity, laboratory equipment for producing and studying high energy particles, nuclear disintegrations, the interaction of nuclear particles with each other and with matter, cosmic rays, and the application of nuclear phenomena to some practical problems. II; 3 hours, or 1 unit. Prerequisite: Physics 381. Mr. Kruger.

PLANT PATHOLOGY

Students may choose a major or minor in plant pathology. Work for the degree of Master of Science or Doctor of Philosophy in Plant Pathology is administered by a committee appointed by the Dean of the Graduate College and representing the various departments which conduct research work in this field. Students considering training in this field should consult with some member of the staff in plant pathology as to their qualifications for entering this field for advanced degrees and to learn of opportunities for financial asssitance during their training. Before registering, candidates must have the approval for the committee which consists of Dr. H. W. Anderson (Chairman), Department of Horticulture; Dr. Benjamin Koehler, Department of Agronomy, and Dr. Leland Shanor, Department of Botany.

Graduate Teaching Faculty

Professors: H. W. Anderson (Chairman), B. Koehler, N. E. Stevens, L. R. Tehon.

Associate Professors: L. Shanor, H. H. Thornberry, F. F. Weinard.

Assistant Professors: D. Gottlieb, M. B. Linn, D. Powell.

Courses for Graduates

Botany 427. Discussions in Mycology. A seminar course designed for discussion of current research activities in the morphology, taxonomy, and physiology of fungi, especially the nonparasitic forms. I, II; ¼ unit. Prerequisite: Consent of instructor. Mr. Shanor.

Botany 471. Advanced Mycology — Special Groups. Special groups of fungi and their activities are considered. Different groups for concentrated study may be selected each semester depending upon the student's interests in mycology. I, II; ½ unit. Prerequisite: Consent of instructor. Mr. Shanor.

404. Plant Virology. Same as Botany 404 and Horticulture 404. Fundamental concepts; classification, symptomology; infectivity; biological, chemical and

physical properties; techniques for transmission, staining, assay, filtration, and purification; control methods; sources of information; history of virology. II; 1 unit. Prerequisite: Consent of instructor. Offered in 1949-1950 and in alternate years. Mr. Thornberry.

417. Discussions in Plant Pathology. Same as Botany 417 and Horticulture 417. Required for majors in plant pathology and as elective for graduate students in plant science. I, II; ¼ unit. Mr. Anderson, Mr. Stevens.

473. Epidemiology of Plant Diseases. Same as Botany 473. I; ½ unit. Prerequisite: A major in plant science or entomology. Offered in 1948-1949 and in alternate years. Mr. Stevens.

491. Thesis. Same as Horticulture 491c and Agronomy 491b. Research on the thesis problem in plant pathology. I; ½ to 4 units. Mr. Anderson, Mr. Gottlieb, Mr. Koehler, Mr. Linn, Mr. Powell, Mr. Stevens, Mr. Thornberry, Mr. Weinard.

492. Thesis. Same as Horticulture 492c and Agronomy 492b. Research on the thesis problem in plant pathology. II; ½ to 4 units. Mr. Anderson, Mr. Gottlieb, Mr. Koehler, Mr. Linn, Mr. Powell, Mr. Stevens, Mr. Thornberry, Mr. Weinard.

493. Research. Same as Agronomy 493b, Botany 493e, and Horticulture 493c. Work may be taken in the following fields subject to approval of one of the staff: fruits, vegetables, field crops, ornamentals, viruses, mycology, metabolism of microorganisms. I; ½ to 4 units. Mr. Anderson, Mr. Gottlieb, Mr. Koehler, Mr. Linn, Mr. Powell, Mr. Shanor, Mr. Stevens, Mr. Tehon, Mr. Thornberry, Mr. Weinard.

494. Research. Same as Agronomy 494b, Botany 494e, and Horticulture 494c. Work may be taken in the following fields subject to approval of one of the staff: fruits, vegetables, field crops, ornamentals, viruses, mycology, metabolism of microorganisms. II; ½ to 4 units. Mr. Anderson, Mr. Gottlieb, Mr. Koehler, Mr. Linn, Mr. Powell, Mr. Shanor, Mr. Stevens, Mr. Tehon, Mr. Thornberry, Mr. Weinard.

Courses for Graduates and Advanced Undergraduates

Botany 372. General Mycology. Structure, classification, and identification of fungi, including those of economic importance. II; 4 hours, or 1 unit. Prerequisite: One year of botany, bacteriology, entomology, or zoology; senior standing, or consent of instructor. Mr. Shanor.

307. Fruit Diseases. Same as Botany 307 and Horticulture 307. Symptomatology; laboratory and field studies of representative diseases; control measures. I; 3 hours, or ½ unit. Prerequisite: Plant Pathology 317 or Botany 372. Offered in 1949-1950 and in alternate years. Mr. Anderson.

308. Vegetable Diseases. Same as Botany 308 and Horticulture 308. Symptomatology; laboratory and field studies of representative diseases; control measures. II; 3 hours, or ½ unit. Prerequisite: Plant Pathology 317 or Botany 372. Offered in 1948-1949 and in alternate years. Mr. Linn.

317. Plant Pathology. Same as Botany 317 and Horticulture 317. Causes, diagnosis, and treatment of plant diseases. I; 3 hours, or ½ unit. Pre-

requisite: Junior standing; one year of plant science including either Botany 100 and 101, or 104, or 105. Mr. Stevens.

379. Research Methods in Plant Pathology. Same as Botany 379 and Horticulture 379. Lectures and laboratory on the techniques for identification of plant diseases and their causal agents; for evaluation of plant protectants; for the study of the physiology of parasitism, and methods for planning research projects, evaluating data, and preparation of manuscripts for publication. I; 3 hours, or ½ unit. Prerequisite: Botany 317; senior standing. Offered in 1949-1950 and in alternate years. Mr. Gerdeman, Mr. Gottlieb, Mr. Thornberry.

POLITICAL SCIENCE

The Department of Political Science offers graduate work leading to the Master of Arts and Doctor of Philosophy degrees. Graduate work is conducted in the following special fields: American government and politics; state and local government; international law and relations; public administration; public law; comparative political institutions; political theory.

Candidates for advanced degrees in political science must have had at least twenty hours of undergraduate work in political science, economics, sociology, and history, not less than twelve hours of which must have been in political science (which may include three hours in constitutional history). If a student making political science his major is taking both of his minors in other departments, one of them must be in history, economics, or sociology.

Several courses given in other departments are so closely related to those in political science that graduate students whose major is political science may be permitted on petition to take such courses as part of their major work. Attention is called to the courses in public law in the College of Law, the courses in public finance in the College of Commerce and Business Administration, the courses in city and regional planning in the College of Fine and Applied Arts, and the courses in municipal and sanitary engineering in the College of Engineering. An extension curriculum in public administration is offered at Springfield, designed particularly as in-service training for persons in the various state services and leading to the master's degree.

Graduate students in other departments who choose political science as a minor must have had at least six hours of undergraduate work in political science and three hours in economics, sociology, or history.

Fellowships

Professor John A. Fairlie, who served on the faculty of Political Science from 1909 to 1941, bequeathed to the University the sum of $20,000, the income of which is to be used as the stipend of the John A. Fairlie Fellowship in Political Science.

The department participates with the Department of History in the Kendric C. Babcock Fellowship established under the will of Dean Kendric C. Babcock. For the third year these appointments carry a stipend of $1,000, and post-doctoral grants carry a stipend of $2,400. Nominations for these fellowships are made by the heads of the departments of Political Science and History. Application forms may be obtained from the Graduate College Office.

Graduate Teaching Faculty

Professors: C. M. Kneier (Chairman of Department), C. A. Berdahl, D. C. Blaisdell (Visiting), R. H. Connery, J. M. Mathews, F. G. Wilson.

Associate Professors: C. B. Hagan, V. Jobst, E. G. Lewis, C. F. Snider.

Instructor: J. M. Edelman.

Courses for Graduates

400. Nature of the State. Principles, methods, and nature of political science; origin, forms, and functions of the state; sovereignty and liberty; organization and forms of government. S; 1 unit. Mr. Wilson.

401. The History of Political Theories. Reading and analysis of the leading political thinkers from the Greeks to the middle of the seventeenth century. I; 1 unit. Mr. Wilson.

402. History of Political Theories. Reading and analysis of the leading political thinkers from the middle of the seventeenth century to the present. II; 1 unit. Mr. Wilson.

406. Municipal Administration. Position of cities in American governmental system; governmental interrelationships; powers; services; current municipal problems. I or II; 1 unit. Mr. Kneier.

410. Problems in Rural Local Government. Research in selected topics. I or II; 1 unit. Mr. Snider.

412. State Government. Research in selected topics in American state government. II; 1 unit. Prerequisite: Political Science 312, or equivalent. Mr. Mathews.

420. Formation of Public Policy. Same as Labor and Industrial Relations 420. An examination of the institutional and dynamic forces that shape the making of policy and its administration in the United States; separation of powers, pressure groups, administrative and legal procedures, and judicial activity. I or II; 1 unit. Mr. Hagan.

421. Government and the Economic Order. Seminar in problems of government regulation of economic activity. This course is concerned with research materials, research papers, and related matters. I; 1 unit. Mr. Hagan.

426. Political Parties. Special problems in political parties; methods and materials of research in this field. I or II; 1 unit. Mr. Berdahl.

431. Problems in British Government. Special topics relating to British government. I or II; 1 unit. Mr. Lewis.

450. Contemporary Governmental Problems. Special problems of current importance. Designed especially for students not majoring in political science. S; 1 unit. Mr. Snider.

451. Constitutional Law. Research in selected topics in the American constitutional system. I; 1 unit. Prerequisite: Political Science 351, or equivalent. Mr. Mathews.

461. Problems in Public Administration. The place of administration in the governmental process; organization; duties; relationships. I; 1 unit. Mr. Connery.

466. Current Administrative Theory. Theories of administrative organization; decision making; the role of the executive; nature of staff functions; problems of communication; advisory boards; growth of administrative organization; psychological factors; efficiency measurement. II; 1 unit. Mr. Connery.

468. Problems in National Administration. Selected problems in the organization and procedures of the national government, with particular reference to the powers of the executive, the operation of the staff agencies and of the line departments. I or II; 1 unit. Mr. Connery.

471. Problems in International Organization. Methods and materials of research in international organization; special topics, such as disarmament, security, procedural problems in the United Nations, economic and social problems, amendment and revision of the Charter. I or II; 1 unit. Mr. Berdahl.

481. Foreign Relations of the United States. Special problems in the development and conduct of American foreign policy. I; 1 unit. Mr. Mathews.

485. International Law. Research in selected topics. I; 1 unit. Mr. Jobst.

486. International Law. Research in selected topics. II; 1 unit. Mr. Jobst.

491. Seminar in Political Science and Public Law. Theses, special problems, reports, discussions, and criticism. I; ½ to 4 units. Staff.

492. Seminar in Political Science and Public Law. Theses, special problems, reports, discussions, and criticism. II; ½ to 4 units. Staff.

Courses for Graduates and Advanced Undergraduates

305. Municipal Government. Growth of cities; their legal status; municipal politics and organization in the United States. I; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Kneier.

306. Municipal Problems. Municipal administration in the United States; administrative organization; personnel problems; financial problems; city planning and housing; police and fire administration; public health; public utilities. II; 3 hours, or ½ to 1 unit. Prerequisite: Senior standing, or junior standing with Political Science 305, or Economics 102 and 103, or six hours of political science. Mr. Kneier.

310. Rural Local Government. Development of local government in rural America; state-local relationships; legal status of local units; organization and functions of counties, townships, school districts, and special-purpose districts; rural politics and elections; local finance; problems of reorganization. II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Snider.

312. Advanced State Government. Relations of the state with national, other state, and local governments; the state constitution and problems of revision; methods of popular control; nature, structure, powers, functions, and pro-

cedure of legislative, executive, judicial, and administrative organs of state government. II; 2 hours, or ½ to 1 unit. Prerequisite: Junior standing; Political Science 150, or equivalent. Mr. Mathews.

315. Legislatures and Legislation. The legislative function in government; structure and organization of American legislatures, national, state, and local; party organization in legislatures; legislative procedure; pressure groups and lobbying; relation of legislature to other branches of government; problems of legislative reorganization. I; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing with six hours of political science.

321. Government and the Economic Order. A survey of public policies of national and state governments regulating economic activity: transportation, electrical utilities, communications, anti-monopoly, agriculture, level of economic activity. I; 3 hours, or ½ to 1 unit. Prerequisite: Any two courses in political science or a combination of political science and economics. Mr. Hagan.

325. Political Parties: History and Issues. Nature of American party system; historical development of parties and issues; third or minor parties and their role. I or II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Berdahl.

326. Political Parties: Organization and Methods. Organization and operation of the American party system; relations between national, state, and local organizations; state and national committees; the convention system; the primary; campaign methods and finance. I or II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Ranney.

331. British Government. Nature of the British constitution; the crown, ministry, and cabinet; Parliament, and elections; the party system; law and the courts; local government; the British Commonwealth. I or II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Lewis.

336. Continental European Governments and Politics. An analysis of the major political systems of continental Europe; constitutional and legal structures of France, Germany, Italy, the Soviet Union, and Spain; factors in the struggle for power; political and social movements as they affect the European scene; relation of political to economic, religious, and social institutions in Europe. II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Lewis.

342. Government and Politics in Latin America. A survey of the origin and development of Latin American political institutions; systems of government; public administrative systems; party government; international policies of Latin American governments. I or II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Scott.

351. American Constitutional System. Judicial interpretation of constitution; separation of governmental powers; relation of state and national governments; control of interstate commerce; jurisdiction of courts. I; 3 hours, or ½ to 1 unit. Prerequisite: Political Science 150; junior standing. Mr. Mathews.

354. The Constitution and Industrial Legislation. Scope of national regulatory power; commerce clause, taxing power; spending power; scope of state

regulatory power; police power and due process limitations. II; 3 hours, or ½ to 1 unit. Prerequisite: Any two courses in political science, or a combination of political science and economics. Mr. Hagan.

356. Administrative Law in the United States. A study of the powers of administration, of the legal requirements for and the limits on the exercise of such powers, of the internal and external means of safeguarding individual rights, and of the enforcement of the responsibility of administrative officers both politically and legally. II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing; Political Science 305, or 351, or 354, or 361, or consent of instructor. Mr. Monypenny.

359. Jurisprudence. Nature and sources of law; law and the state; law and justice; evolution, arrangement, and subject matter of law. I or II; 3 hours, or ½ to 1 unit. Prerequisite: Political Science 150, or equivalent; junior standing. Mr. Manner.

361. Introduction to Public Administration. Development of administrative organization; administration and the executive, legislature and judiciary, principles of organization, including line and staff relationships; the staff services of finance and personnel; formal and informal control. I; 3 hours, or ½ to 1 unit. Prerequisite: Political Science 150; junior standing. Mr. Monypenny.

362. Problems of Public Administration. A study of selected administrative problems including the following: inter-governmental administrative relationships in finance and in particular functions; the place of unofficial organizations in administrative functions; the techniques, advantages, and disadvantages of decentralization; the future of the government corporation; the problem of responsibility and control in administration. II; 3 hours, or ½ to 1 unit. Prerequisite: Political Science 361; junior standing. Mr. Connery.

363. Administrative Management. A survey of methods of applying principles of public administration to operating agencies; particular emphasis will be placed on means of administrative coordination and techniques of administrative control. I or II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing and Political Science 361, or 364, or consent of instructor. Mr. Connery.

364. National Administration. Creation and development of the national administrative organization; the executive departments; regulatory, service, and staff agencies; special organization for emergency and war; efforts at reorganization and coordination. I or II; 3 hours, or ½ to 1 unit. Prerequisite: Six hours of political science, including either Political Science 150 or 151. Mr. Connery.

365. Administration of Federal Labor Law. Same as Labor and Industrial Relations 365. Role of administration in the effectuation of public policy; organization and procedures of major federal labor agencies; types of policies formulated by federal labor agencies; experience of bureaus of Department of Labor, National Labor Relations Board, United States Employment Service, National Mediation Board, War Labor Board, and others. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Political Science 150. Mr. Edelman.

371. International Organization. General development of world organization, forms of world organization, basic principles of international society, the problem of war, peaceful settlement of disputes. I or II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Berdahl.

372. International Organization. Principles, structure, methods, and actual operation of international governmental institutions; special attention to the League of Nations, the United Nations, and related agencies. I or II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Berdahl.

373. International Administration. International administrative agencies; international unions and other agencies for functional purposes; organization, procedure, and personnel of international secretariats; budgets and financial administration; international territory; mandates and trusteeships. I or II; 2 hours, or ½ to 1 unit. Prerequisite: Political Science 372, or equivalent; junior standing. Mr. Berdahl.

381. American Foreign Relations. Participation in international affairs; presidential initiative; development and organization of the Department of State; diplomatic intercourse; consular service; treaty making power; development of foreign policy. II; 2 hours, or ½ to 1 unit. Prerequisite: Junior standing with six hours of political science.

384. International Relations. An examination of the nature of the national state system; of the forces affecting international relations; of the sources of conflicts in international politics; and of their solution by power politics or by international cooperation. I or II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Manner.

385. International Law. Nature, sources, and development of international law; rights and duties of states; law of peace and war. I; 3 hours, or ½ to 1 unit. Prerequisite: Senior standing, or junior standing with six hours of political science. Mr. Jobst.

386. International Law. Continuation of Political Science 385. Nature, sources, and development of international law; rights and duties of states; law of peace and war. II; 3 hours, or ½ to 1 unit. Prerequisite: Political Science 385, or consent of instructor. Mr. Jobst.

391. Principles of Political Science. A survey and analysis of the modern state; methods of study in political science; sovereignty and the legal nature of the state; forces and interests in politics; forms of government; the nature of democracy and international society. I; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Offered in 1949-1950 and in alternate years. Mr. Wilson.

393. History of Political Theory. A survey of the major trends and issues in European political thought from ancient times to 1850. Greek and Roman theories of politics; the development of Christian political thought and the Middle Ages; political theory during Renaissance, Reformation, and the Counter Reformation; early modern absolutism, the emergence of constitutional government, and the theory of democracy; the Enlightenment, European liberalism, conservatism, Utopianism, and pre-Marxian socialism. I or II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Wilson.

396. Contemporary Political Theory. Major tendencies in Western political theory since 1850; conservatism and constitutionalism; the religious interpretation of the state and economic institutions; Marxism, socialism, and communism; anti-democratic thought and totalitarian regimes. Students may not receive credit for both Political Science 396 and Philosophy 104. II; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Mr. Wilson.

397. American Political Theory. A survey of American political thought from colonial times to the present. I; 3 hours, or ½ to 1 unit. Prerequisite: Junior standing. Offered in 1948-1949 and in alternate years. Mr. Wilson.

PSYCHOLOGY

The Department of Psychology offers graduate work leading to advanced degrees in the following four areas: Area I, Teaching and Research; Area II, Industrial Psychology; Area III, Clinical Psychology; Area IV, Counseling and Guidance.

Areas II to IV, inclusive, correspond to the professional fields in which the American Board of Examiners in Professional Psychology awards diplomas, provided its standards of qualifications have been satisfied, usually as determined by oral and written examinations. In this connection, it is emphasized that the master's degree is not regarded as a terminal degree in the sense that it fulfills the academic preparation for becoming a professional psychologist. The educational purposes associated with Area III can not be realized short of four years (eight semesters) of graduate training (including a year devoted to an internship). The Department of Psychology recommends that study in this area be pursued only by those students who intend to complete such a program.

To qualify for admission to the Graduate College with full graduate standing in psychology, a student must have had a minimum of sixteen semester hours in undergraduate psychology courses, including at least one undergraduate course in both statistics and experimental psychology (with laboratory). A student proposing to specialize in Area II, III, or IV must also have had in the case of Area II a course in applied or industrial psychology, and in the case of Area III or IV a course in child psychology or child development and a course in clinical psychology. A student may be admitted to graduate work without having fully completed these prerequisites, but will then be required to devote a portion of his time to the removal of his deficiencies.

In all areas, programs are provided which lead to the master's degree and to the Doctor of Philosophy degree. The master's degree offered for work completed in Area I, II, or IV is that of Master of Arts; for work completed in Area III, it is that of Master of Science in Clinical Psychology. The requirements for the latter degree are completion of a year of work (a minimum of eight units) in the Urbana departments and an internship of six months in an institution, agency, or department recommended by the Department of Psychology and approved by the Dean of the Graduate College. No thesis is required. The work in Urbana shall include a minimum of four units in psychology and two units to be chosen from education and sociology. A departmental requirement for the degree of either Master of Arts or Master of Science in Clinical Psychology is the passing of a comprehensive written examination in the general field of psychology. This

examination must be passed by candidates for the degree of Master of Science before entering upon the internship.

A departmental requirement for the degree of Doctor of Philosophy, in the case of students following the program of Area III (Clinical Psychology), is a year's internship. This internship normally constitutes the third year of work and must be certified as satisfactorily completed by an approved institution. While data for the doctor's thesis may in some cases be secured during the internship, an additional year is normally required for writing the thesis and carrying out the research on which it is based.

Practice courses (or practicums) are offered which provide practical work in the Student Counseling Bureau, the Office of Nonacademic Personnel, and the Psychological Clinic. The staff of the Psychological Clinic includes, in addition to clinical psychologists, a part-time psychiatrist and a full-time psychiatric social worker. Other facilities for graduate work include a statistical laboratory, an animal laboratory, and well-equipped laboratories for research in experimental psychology and in aviation psychology. The Department also makes extensive use, particularly for internships, of facilities provided by the Institute for Juvenile Research and by a number of Illinois state hospitals. The Veterans Administration Hospital in Danville, Illinois, is used both for internships and practice courses by students who have been admitted to the Veterans Administration program for training in clinical psychology.

Fellowships

The Department of Psychology recommends each year a small number of students for United States Public Health Service training stipends. The amount of these stipends, given only to qualified students specializing in clinical psychology, is $1,200 for first-year graduate students and increases by $400 a year to $2,400 for fourth-year graduate students. Acceptance of one of these stipends does not entail any duties of teaching or service, and appointees are ordinarily given the rank of fellows. The Department also participates in the program for graduate training in clinical psychology of the United States Veterans Administration. In connection with this program, the Department recommends each year a small number of students for appointment as part-time interns.

Graduate Teaching Faculty

Professors: H. Woodrow (Head of Department), M. E. Bunch, R. B. Cattell, G. D. Higginson, L. I. O'Kelly, O. H. Mowrer, R. Stagner, P. T. Young.

Associate Professors: R. M. Collier, T. W. Harrell, L. L. McQuitty, L. A. Pennington.

Assistant Professors: J. B. Cohen, T. N. Ewing, W. M. Gilbert, G. R. Grice, L. A. Hellmer, A. L. Irion, W. G. McAllister, Mary K. Smith, A. C. Williams.

Courses for Graduates

404. Physiological Psychology. I or II; 1 unit. Prerequisite: Psychology 211 and 278, or consent of instructor. Mr. Cohen, Mr. O'Kelly.

406. Quantitative Methods. Methods of inductive research with quantitative data in psychology. I or II; 1 unit. Prerequisite: Psychology 135, or an

equivalent course in statistical methods; consent of instructor. Mr. Cohen, Mr. McQuitty.

409. Problems in Motivation. I or II; 1 unit. Mr. Young.

412. Advanced Child Psychology. I or II; 1 unit. Prerequisite: Consent of instructor.

415. Experimental Psychology. A study of experimentation in the various fields of psychology, with emphasis on types of problems investigated, apparatus used, and methods of experimental design. I, II; 1 unit. Prerequisite: Fourteen hours of psychology, including a laboratory course in experimental psychology and a course in elementary statistics. Mr. Bunch.

418. Experimental Psychology of Learning. A study of experimental investigations of the learning process, with emphasis on types of problems studied, methods of procedure, and theoretical significance of results. I, II; 1 unit. Prerequisite: Fourteen hours of psychology, including a laboratory course in experimental psychology. Mr. Bunch.

428. Systematic Psychology. A critical analysis and comparison of modern and contemporary psychological systems. I, II; 1 unit. Prerequisite: Full graduate standing in psychology (sixteen hours of psychology). Mr. Woodrow.

430. Contemporary Behavior Theory. An introduction to modern attempts to formulate scientific theories of behavior. Special emphasis on theories concerning the learning process, including the work of Hull, Tolman, and Guthrie. I or II; 1 unit. Prerequisite: Graduate standing in psychology.

434. Test Construction. A systematic development and critical consideration of the theories, methods, and techniques in test construction. I or II; 1 unit. Prerequisite: A course in statistics. Mr. McQuitty.

436. Personality. A survey of experimental and theoretical studies of human personality, including its development, modification, and relation to society. I; 1 unit. Prerequisite: Psychology 150, 286, and 338, or their equivalent. Mr. Cattell, Mr. Stagner.

438. Intelligence. The nature, causes, and consequences of individual differences in intelligence. I or II; 1 unit. Prerequisite: A course in statistics, Psychology 286 or 465; consent of instructor. Mr. Woodrow.

441. Measurement of Opinion and Attitude. Same as Journalism 441. Theory and practice in measurement of opinion and attitude formation and change. Attitude scales; factors affecting morals; interpretation of results from social and psychological characteristics of the population; intensity of attitudes; relations among attitudes and opinions. I or II; 1 unit. Prerequisite: Psychology 100; a course in statistics; a course in sociology, social psychology, advertising, or market research. Mr. Harrell.

446. The Psychodynamics of Social Groups. An advanced course in social psychology for graduates which deals largely with the dynamics of group life. I; 1 unit. Prerequisite: A course in abnormal psychology or mental adjustment; a course in statistics; consent of instructor. Offered in 1948-1949 and in alternate years. Mr. Cattell.

448. History of Psychology. I or II; 1 unit. Prerequisite: Eighteen hours of psychology. Mr. Grice.

451. Personnel Psychology in Business and Industry. The application of psychological principles and procedures to personnel methods in industry and business. I, II; 1 unit. Prerequisite: Psychology 290; consent of instructor. Mr. Harrell.

455. Practice in Industrial Psychology. Intensive practice on projects in the Office of Nonacademic Personnel. I, II; 1 unit. Prerequisite: A course in industrial psychology and in tests and measurements; consent of instructor. Mr. Harrell, Miss Hansen.

459. Human Factors in Equipment Design. Experimental psychology applied to the design of machines and equipment for human use, with special reference to aviation and aircraft. I or II; 1 unit. Prerequisite: Psychology 130 and 135, or their equivalent; consent of instructor. Mr. Williams.

461. Behavior Disorders. Psychological study of the behavior disorders, with special emphasis on the analysis of the individual case as encountered in the behavior clinic. The course also provides a study of the biosocial approach to the behavior disorders and a review of recent experimental-clinical literature pertaining to the problem. I, II; 1 unit. Prerequisite: Psychology 135, 286, 338, or their equivalent; consent of instructor.

465. Practice in Psychological Testing. Instruction and practice in the administration and interpretation of individual tests of general intelligence, special abilities, and achievement. I, II; 1 unit. Prerequisite: Graduate standing in psychology; Psychology 286, or equivalent. Mr. Collier and others.

468. Practice in Projective Techniques. Designed to give practical training in the administration of clinical techniques commonly used in psychological diagnosis. Emphasis on the Rohrschach test. I, II; 1 unit. Prerequisite: Psychology 465, or equivalent; consent of instructor. Mr. Hellmer.

471. Psychological Counseling and Psychotherapy. Critical examination of the methods and theories of psychological counseling, psychotherapies, and remedial treatment in the psychological clinic. I; 1 unit. Prerequisite: Psychology 216, 286, and 465. Mr. Collier.

472. Practice in Psychological Counseling and Psychotherapy. A practicum course in methods of interviewing, counseling, and psychotherapy under supervision. Open only to students who have completed Psychology 471. II; 1 unit. Prerequisite: Psychology 216, 286, 465, and 471. Mr. Collier.

474. Theory and Research in Psychotherapy. Study and analyses of clinical recordings in the light of contemporary theory of neurosis, with special reference to research problems and methods. I or II; 1 unit. Prerequisite: Psychology 472, or equivalent, or concurrent registration therein. Mr. Mowrer.

476. Practice in Psychological Counseling and Therapy with College Students. The psychological principles and techniques of student personnel work, with special reference to counseling procedures utilized at the college

level. Supervised observation and practice in the Student Counseling Bureau. I, II; 1 unit. Prerequisite: Completion of course requirements for master's degree in psychology or education; sixteen hours of psychology; Psychology 383, or equivalent; fitness for referred student counseling as determined by the instructor. Mr. Gilbert.

478. Neurophysiology for Clinical Psychologists. A clinical approach to the study of the anatomy and physiology of the nervous system together with descriptions of typical malfunctions; designed primarily for the student in clinical psychology who expects to work with institutional cases. II; 1 unit. Prerequisite: Graduate standing in psychology; appointment in the Cooperative Veteran's Administration training program for clinical psychologists; consent of instructor.

482. Practice in Clinical Psychology. Practice in clinical case study, including personal and social histories; training in the interpretation of reports of medical examiners, teachers, social agencies, etc.; participation in the regular work of psychological clinic; training in diagnostic testing, diagnostic and therapeutic interviewing, and preparation of clinic reports. I, II; 1 to 2 units. Prerequisite: Psychology 465 and 468; credit or registration in Psychology 471. This course is required in second-year graduate training in clinical psychology. Mr. Collier.

491. Research and Thesis. Experimental investigation. I; ½ to 4 units. Mr. Bunch, Mr. Cattell, Mr. Collier, Mr. Grice, Mr. Harrell, Mr. Hellmer, Mr. Higginson, Mr. Irion, Mr. McQuitty, Mr. Mowrer, Mr. Pennington, Mr. Stagner, Mr. Williams, Mr. Woodrow, Mr. Young.

492. Research and Thesis. Experimental investigation. II; ½ to 4 units. Mr. Bunch, Mr. Cattell, Mr. Collier, Mr. Grice, Mr. Harrell, Mr. Hellmer, Mr. Higginson, Mr. Irion, Mr. McQuitty, Mr. Mowrer, Mr. Pennington, Mr. Stagner, Mr. Williams, Mr. Woodrow, Mr. Young.

493. Research Seminar. Discussion of current topics in their historical setting, with special emphasis on research problems. I; 1 unit. Prerequisite: Fourteen hours of psychology; consent of instructor. Staff.

494. Research Seminar. Discussion of current topics in their historical setting, with special emphasis on research problems. II; 1 unit. Prerequisite: Fourteen hours of psychology; consent of instructor. Staff.

Courses for Graduates and Advanced Undergraduates

338. Abnormal Psychology. An introduction for preprofessional students to the psychological aspects of the behavior disorders, including study of the insanities, psychoneuroses, mental deficiencies, and other conditions. I, II; 3 hours, or ½ unit. Prerequisite: Six hours of psychology; junior standing except for those in the Premedical Curriculum who may take the course as second semester sophomores with four hours of psychology. Mr. Irion.

345. Comparative Psychology. Animal behavior with particular reference to the behavior of vertebrates. I or II; 3 hours, or ½ unit. Prerequisite: Six hours credit in psychology, or Psychology 100, 103, or 106, and one course in zoology. Mr. McAllister.

360. Psychology of Exceptional Children. A survey from the psychological viewpoint of the various types of exceptional children. Emphasis on case studies. I or II; 3 hours, or ½ unit. Prerequisite: Psychology 286, or equivalent. Miss Smith.

383. Student Personnel Work. The application of psychological principles and techniques in fitting education processes to the needs, interests, and abilities of the individual college student. I, II; 3 hours, or ½ unit. Prerequisite: Psychology 338; a course in statistics; senior standing. Mr. Ewing.

SOCIAL SCIENCES

Through the Division of the Social Sciences (including economics, geography, history, philosophy, political science, psychology, social welfare administration, and sociology), a special program leading to the degree of Master of Arts in the Social Sciences is available to meet the needs of students who wish to study in several related fields within the social sciences rather than to specialize in one department, and the needs of those who contemplate teaching the social sciences. To qualify for this program a student, in addition to meeting the general requirements of the Graduate College, must have had twenty hours of undergraduate credit in the social sciences, and preparation in the particular departments within the division in which he elects to work substantially equivalent to the minor requirements of those departments. Work must be done in at least three departments within the division, or in two departments and in education. If work in education is elected, it may not exceed two units. No thesis is required, but to qualify for the degree, a student must pass a comprehensive examination.

The chairman of the Division of Social Sciences is Professor R. P. Stearns, 313 Lincoln Hall.

Candidates for the degree of Master of Arts in the Teaching of Social Studies must earn four units in social studies, two units in education, and two units in electives. Requirements are (1) social studies selected from not more than three of the following: economics, geography, history (at least 2 units), sociology, philosophy, and political science, 4 units; (2) Education 400, Educational Philosophy, or Education 302, History of American Education, 1 unit; and (3) Education 409, Advanced Educational Psychology, 1 unit. The courses in social studies and the electives must be selected with the approval of the advisor. The electives may be in the social studies, in education, or, in exceptional cases, in other fields. The advisor for candidates for this degree is Professor F. C. Dietz, 331 Lincoln Hall.

SOCIAL WELFARE ADMINISTRATION

The Division of Social Welfare Administration offers graduate work leading to the degree of Master of Social Work.

The Division has established an Admissions Committee which is charged with the responsibility of determining the potentialities of the applicant to acquire and utilize professional education in social work. The Committee's scrutiny of scholastic achievement is directed principally to the applicant's record in the social sciences

and preprofessional courses and in those courses which reveal mastery of the English language. A minimum of twenty hours in social science courses is required. Preference is given the student whose background includes such course content as psychology, sociology, economics, political science, social anthropology, history, biology, philosophy, and preprofessional courses such as statistical methods, introduction to social work, child welfare, and introduction to group work. Applicants must have full admission status to be accepted by the Division of Social Welfare Administration.

In addition to scholastic achievement and admission to the Graduate College, the Admissions Committee attempts to determine the applicant's personal suitability for professional education in social work, in terms of age, health, and personal qualities. Preference is given to the applicant between the ages of 21 and 35; however, consideration is given to an older applicant who has demonstrated his capacity for social work practice. Admission is granted only to the applicant whose health and physical condition are sufficiently good to permit his undertaking a study program which taxes physical and emotional energy. Admission is granted to the applicant who shows evidence of emotional maturity commensurate with his years and past experience; interest in and a liking for people, and ability to establish harmonious and healthy relationships; demonstrated capacity to make the kind of social adjustment which allows for a variety of social interests; personal integrity as demonstrated by intellectual honesty and a sense of responsibility. Serious lacks in these areas will disqualify the applicant.

Because of the limited number of field work placements in acceptable social agencies, the Division of Social Welfare Administration is compelled to limit its enrollment of students for the degree program to the number of field work placements available.

Application must be made to the Division of Social Welfare Administration in addition to the application for admission to the Graduate College.

The first year of graduate work is generic but there are opportunities for specialization during the second year. The Master of Social Work degree is conferred by the Division at the completion of two years of satisfactory graduate work.

Fellowships

Several scholarships are provided by social agencies for students who are interested in accepting employment after graduation. Local, state, and national agencies have special scholarships of varying amounts. It is suggested that applicants consult with the Division of Social Welfare Administration regarding the provisions.

Graduate Teaching Faculty

Professor and Director of Division: Marietta Stevenson.

Associate Professors: Florence I. Hosch, W. P. Simon.

Assistant Professors: E. Linzer, Rachel Marks, J. E. McDonald, Annie L. Pruitt, Esther Schour.

Lecturers: Carroll L. Birch, J. Borus, R. L. Jenkins, Mary S. Kunst, Virginia Lehmann, J. B. Richmond.

Instructors: Marjorie W. Main, Bernice Perlman.

Courses for Graduates

401. Field Instruction in Social Case Work I. Field work units are maintained in public and private welfare agencies. In the first year, students are placed in an agency giving training in generic case work practice, which is focused on the family as a unit. The minimum time requirement in field work is fifteen hours a week. Social Welfare Administration 411 must be taken concurrently. I, II; 1 unit. Mr. Linzer, Mr. McDonald, and Agency Supervisors.

402. Field Instruction in Social Case Work II. Continuation of Field Instruction I. Social Welfare Administration 412 must be taken concurrently. I, II; 1 unit. Prerequisite: Social Welfare Administration 401 and 411. Mr. Linzer, Mr. McDonald, and Agency Supervisors.

403. Field Instruction in Social Group Work I. A course of tutorial instruction specifically designed to help the student acquire and develop mastery and skill in the practice of group work through actual field experience in selected social agencies. The student's records constitute the primary basis of discussion. Fifteen hours a week for one semester. A classroom practice course in social group work must be taken concurrently. I, II; 1 unit. Miss Main, Mrs. Perlman, and Agency Supervisors.

404. Field Instruction in Social Group Work II. Continuation of Field Instruction I. Fifteen hours a week for one semester. A classroom course in social group work must be taken concurrently. I, II; 1 unit. Prerequisite: Social Welfare Administration 403. Miss Main, Mrs. Perlman, and Agency Supervisors.

405. Field Instruction in Social Work III. An advanced course with field work placement in a social agency selected with reference to specific aptitudes, choice or needs of the student. The objective is to provide an opportunity for continued development of skill in practice. An advanced classroom course in social case work or social group work must be taken concurrently. I, II; 1 unit. Prerequisite: Either Social Welfare Administration 401 and 402, or 403 and 404. Miss Pruitt, Mr. Simon, and Agency Supervisors.

406. Field Instruction in Social Work IV. The fourth semester in field instruction is aimed toward integrating the total learning of the previous semesters with field work selected to implement the transition from student to agency worker. An advanced classroom course in social case work or social group work must be taken concurrently. I, II; 1 unit. Prerequisite: Social Welfare Administration 405. Miss Pruitt, Mr. Simon, and Agency Supervisors.

411. Social Case Work I. An introduction to generic principles of social case work philosophy and their application in practice. Attention is focused on understanding the individual in relation to his social situation; the development of a disciplined point of view about behavior manifestations; beginning awareness of interaction between client, worker, agency, and community. Case material from several functional fields is used for study and discussion. I, II; 1 unit. Mrs. Schour.

412. Social Case Work II. Continuation of Social Case Work I with study focused on the social case work process. Case records are analyzed to enable

development of differential diagnostic and treatment skills. Attention is given to interviewing, recording, and appropriate use of community resources. I, II; 1 unit. Prerequisite: Social Welfare Administration 411. Mrs. Schour.

413. Social Case Work III. Continuation of Social Case Work II with study focused on the dynamics of family relationships to enable the student to deepen his understanding of the client's emotional and social needs. Case records are used for study and discussion, with emphasis on the generic use of the social case work method of helping the individual within the framework of different agency settings. I; 1 unit. Prerequisite: Social Welfare Administration 411 and 412. Miss Pruitt.

414. Case Work with Children. Study of case records with emphasis on principles and methods utilized in working with children. Consideration is given to their treatment through parent-child relationships, child placement, the selection and use of foster homes and institutions. II; 1 unit. Miss Pruitt.

425. Supervision in Social Case Work. This course is designed for supervisors in the social case work field. Discussion focused on the content of supervision and the use of relationships in the supervisory process. Students will be given the opportunity to present problems from their own experience. II; 1 unit.

431. Social Group Work I. A course in the fundamentals of group work. Consideration of the principles of group work, involving knowledge basic to the understanding of individuals and their participation in group life, the dynamics of group processes, the application of this knowledge in group situations. Record material will be used as the basis for discussion. I, II; 1 unit. Mrs. Perlman.

432. Social Group Work II. Continuation of Social Group Work I with emphasis on the role and function of the group worker. Analysis of group work methods in actual problem situations. I, II; 1 unit. Prerequisite: Social Welfare Administration 431. Mrs. Perlman.

433. Social Group Work III. An advanced course in group work practice focused on work with groups in various settings such as youth agencies, hospitals, community centers, and clinics. Specific attention is given to problems of departmental program, planning, study, and research. I or II; 1 unit. Prerequisite: Social Welfare Administration 431 and 432. Mr. Simon.

434. Social Group Work IV. A seminar course. Consideration of principles of social group work methods with specific application to administrative processes in agencies using group work method. Examination of structure and function of agencies as related to broad social needs. Principles of agency-wide program development. Problems of specialized application of group work method in medical, psychiatric, and other fields. Discussion based on material drawn from students' field experience and presented in class. I or II; 1 unit. Prerequisite: Social Welfare Administration 433. Mr. Simon.

435. Group Work Program Analysis I. A course in the place and use of program activities carried on in the process of group life. Such activities are ex-

amined from the point of view of their use as a tool in enabling the group to carry out satisfying activities as related to the needs, interests, and objectives of the members. I or II; ½ unit. Miss Main.

436. Group Work Program Analysis II. Continuation of Group Work Program Analysis I. Aimed toward helping the student increase his skill in the use of program activities; ways of relating activities to needs of individuals and groups of various ages in the life cycle. Specialized problems in intergroup situations. Actual practice of the student is analyzed in class discussion. I or II; ½ unit. Prerequisite: Social Welfare Administration 435. Miss Main.

439. Supervision in Group Work. A course dealing with supervisory and program administrative responsibilities. Emphasis is on educative methods of supervision of staff workers and volunteers. Records and problems are used as the basis of discussion. I; 1 unit. Mr. Simon.

441. Community Organization. An examination of the problem of identifying social needs in the community and of developing programs to meet them; analysis of the function of the community chest, council of social agencies, social service exchange, social settlement, etc.; the function of the professional worker in the process of social planning. I, II; 1 unit. Mrs. Hosch.

445. History of English Philanthropy and Social Welfare. Survey of the developments of public social service in England, with special attention to the work of individual reformers, prison reform, reform of the criminal law, growth of services for children, public education, and care of the handicapped groups. I; ½ unit. Mrs. Hosch.

446. History of American Philanthropy and Social Welfare. A survey of the developments of public and private social services in the United States. Special attention to the work of individual reformers and to the relationship to similar developments in England. Growth of services to children, care of the handicapped groups, beginning of public health and housing legislation. II; ½ unit. Prerequisite: Social Welfare Administration 445. Mrs. Hosch.

451. Psychiatric and Medical Information for Social Workers I. Information on normal personality growth from infancy through old age, covering the biological, psychological, medical, and social foundations of human behavior; abnormal behavior in the light of the medical, psychological, and social factors which have contributed to mental illness. Prevention, social implications, and treatment possibilities discussed in terms of what the social worker should understand as to cause, diagnosis, treatment, and effects. I; 1 unit. Mrs. Hosch, Dr. Richmond, and others.

452. Psychiatric and Medical Information for Social Workers II. Continuation of Social Welfare Administration 451. II; 1 unit. Prerequisite: Social Welfare Administration 451. Mrs. Hosch, Dr. Richmond, and others.

455. Medical Social Information. A survey of the need for health services. The organization and functions of existing medical care programs, public and private. Present theories and trends in respect to the social and economic aspects of public health. I or II; 1 unit. Mrs. Hosch.

456. Advanced Social Psychiatry. This course is designed to further meet the needs of social workers for a background knowledge of psychopathology and psychotherapy. It includes a further consideration of mental and nervous disorders, maladjustments, and faulty patterns of personal and social integration, with emphasis upon psychodynamic factors in their origin and psychotherapeutic elements in their management. I, II; 1 unit. Dr. Jenkins.

463. Public Assistance. The old poor laws and system of local relief; unemployment relief during the depression; work relief; public assistance under the Social Security Act; war-connected types of assistance; and international public assistance. The emphasis is on tracing developments, analyzing current problems, and discussing the improvements needed in public assistance. I; 1 unit. Miss Stevenson.

464. The Law and Social Work. The principles of law with which the social worker should become familiar; those defects in judicial administration that especially affect persons with low incomes; the sources of preventable delay and cost; the establishment of small claims and conciliation courts; the growth of legal aid societies and their work. I, II; 1 unit. Mrs. Lehmann.

465. Problems in Child Welfare Administration. Development of methods of administering laws relating to child dependency, delinquency, and neglect, with special emphasis on provisions in regard to adoption, foster care, and services to children in their own homes. I; 1 unit. Miss Pruitt.

466. Social Insurance. Social insurance legislation and administration in Europe and the United States, with special reference to the experience in this country. Deals with the problems arising under the different titles of the Federal Social Security Act, with reference to current problems. I; 1 unit. Mr. Borus.

471. Public Welfare Organization and Administration. Development of the public welfare services, with special reference to intergovernmental relationships; present administrative problems of federal, state, and local agencies with relation to organization, staffing, financing, directing, supervision, etc. II; 1 unit. Miss Stevenson.

472. Seminar in Public Welfare Administration. Current problems in public welfare organization and administration will be analyzed. I, II; 1 unit. Prerequisite: Social Welfare Administration 463 and 471. Miss Stevenson.

491. Research. Preparation of thesis. Required of each candidate for a degree. I, II; 1 unit. Miss Marks.

492. Research. Preparation of thesis. Required of each candidate for a degree. I, II; 1 unit. Miss Marks.

Courses for Graduates and Advanced Undergraduates

311. Introduction to Social Case Work. This course for employed workers deals with the behavior and attitudes expressed by persons asking for assistance, the feelings thus engendered, and the effects of all of these on the contacts of social case workers with individuals and families. Attention will be given to case records selected from social case work practice in public assistance and other community agencies. I, II; 2 hours, or ½ unit. Miss Pruitt.

SOCIOLOGY AND ANTHROPOLOGY

Graduate students electing sociology as their major must have had at least eight hours of undergraduate work in sociology and fifteen hours in one or more of the following subjects: anthropology, philosophy, history, psychology, genetics, economics, and political science. Sociology 285 is required of all graduate majors in this department. Those who select sociology as a minor must have had at least six hours of undergraduate work in sociology.

Graduate Teaching Faculty

Professors: J. W. Albig (Chairman of Department), G. S. Delatour (Visiting), M. J. Herskovits (Visiting), D. E. Lindstrom, D. R. Taft, F. W. Znaniecki.

Associate Professors: J. C. McGregor, B. F. Timmons.

SOCIOLOGY

Courses for Graduates

400. General Sociology. I; 1 unit. Mr. Delatour.

418. Seminar in Human Relations in Industry. Same as Labor and Industrial Relations 418. Individual research in sociological interpretation of industrial organization; the orientation and motivation of the individual in industry and commerce; labor-management relations as group adjustments; the interrelations of industry and the community. I; 1 unit. Prerequisite: Six hours of sociology including Sociology 318, or consent of instructor. Mr. Wray, Mr. Dubin.

420. Seminar in Education for Marriage and the Family. I or II; 1 unit. Prerequisite: Sociology 220 recommended. Mr. Timmons.

422. Theory of Social Groups. Seminar on comparative analysis of various social groups, their origin, composition, structure, functional organization, and dynamic relationships with other groups. I or II; 1 unit. Mr. Znaniecki.

424. Seminar in Penology. I or II; 1 unit. Prerequisite: Sociology 331, or equivalent. Mr. Taft.

430. Seminar in Social Effects of Poverty, Their Prevention and Treatment. I or II; 1 unit. Prerequisite: Sociology 230 and undergraduate economics recommended. Mr. Timmons.

431. Seminar in Criminology. I or II; 1 unit. Prerequisite: Sociology 331, or equivalent. Mr. Taft.

444. Seminar in Public Opinion. I, II; 1 unit. Mr. Albig.

447. Sociology of International Conflict. A consideration of materials bearing on cultural and sociological aspects of the causation of modern war together with their relationship to political, psychological, and economic aspects. I; 1 unit. Mr. Taft.

471. Regionalism and Social Morphology. Specific analysis of the problems which apply to regional bases and not to the conventional political boundaries. I or II; 1 unit.

476. Urban Communities and Urbanization. Intensive study of special aspects of the urbanization process as it affects the life of communities in this and in other countries. I or II; 1 unit.

477. Rural Community Organization. Same as Agricultural Economics 477. A study of rural community structure, functions, and processes, to give the student a concrete picture of how rural communities operate, and the forces which cause change in the group life of the people living in a rural community. I or II; 1 unit. Mr. Lindstrom.

480. Sociological Theory and Method. Seminar on the methods of scientific research by which original contributions to sociological theory are made. I or II; 1 unit. Mr. Znaniecki.

481. Seminar in Culture Integration. I or II; 1 unit. Mr. Delatour.

482. Recent Developments in Sociology. II; 1 unit. Mr. Albig.

488. European Sociological Theory. Selected problems of contemporary sociological thought, e.g., the question of objectivity (sociology of knowledge); what constitutes sociology as a special science; the problem of social dynamics. I or II; 1 unit. Prerequisite: Sociology 100. Mr. Znaniecki.

491. Research and Thesis. Preparation of theses. I; ½ to 3 units. Staff.

492. Research and Thesis. Preparation of theses. II; ½ to 3 units. Staff.

Courses for Graduates and Advanced Undergraduates

315. Sociology of Education. Same as Education 315. Objective comparative study of education as a social process in various cultures and historical periods, with main emphasis on present education in countries which share Western civilization. I or II; 3 hours, or ½ unit. Prerequisite: Sociology 100; junior standing. Mr. Znaniecki.

318. Human Relations in Industry. Same as Labor and Industrial Relations 318. Sociology of industry and problems of personal adjustment. The emergence of modern industrial and labor organizations and their impact upon community life. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Senior standing; Psychology 100, Sociology 100, or consent of instructor. Mr. Dubin, Mr. Wray.

320. Social Roles. Comparative study of organized participation of individuals in social life and culture. I or II; 3 hours, or ½ unit. Prerequisite: Sociology 100; junior standing. Mr. Znaniecki.

324. Penology. Probation; parole; methods of institutional treatment. I or II; 3 hours, or ½ unit. Prerequisite: Sociology 331. Mr. Taft.

327. National Culture Societies. A comparative sociological survey of the formation, social organization, and interaction of modern nationalities as cultural groups. I or II; 3 hours, or ½ unit. Prerequisite: Junior standing. Mr. Znaniecki.

331. Criminology. Crime from the point of view of personality and social situations. I, II; 3 hours, or ½ unit. Prerequisite: Sociology 100; junior standing; open to prelegal juniors by consent of instructor. Mr. Taft.

332. Prevention and Treatment of Juvenile Delinquency. I or II; 3 hours, or ½ unit. Prerequisite: Sociology 100 or 331; junior standing. Mr. Esselstyn.

344. Public Opinion. Opinion changes and control; propaganda; interest groups and opinion; critical review of methods of measurement. I, II; 3 hours, or ½ unit. Prerequisite: Sociology 100; junior standing. Mr. Albig.

347. Sociology of International Conflict. War as a social process. Conflict of national cultures, population pressures, race relations, immigration policies, restrictions on communication and other elements in the international conflict process. Occupation policies in Germany and Japan. Implications of social science for changes in the process. II; 3 hours, or ½ unit. Prerequisite: Senior standing; Sociology 327 recommended. Mr. Taft.

375. The Community. Nature, structure, and functions of the community. Types of communities and examples of some better community studies. The relation of the community to the larger social organization. I or II; 3 hours, or ½ unit. Prerequisite: Sociology 100; senior standing, or 11 hours of sociology. Mr. Timmons.

378. Immigration and Assimilation. II; 3 hours, or ½ unit. Prerequisite: Five hours of sociology.

ANTHROPOLOGY

Courses for Graduates and Advanced Undergraduates

353. Southwestern Archaeology. This course is a detailed study of one archaeological unit in the United States. It covers the three broad cultures with regional variations considered chronologically and stressing inter-relationships of the various cultures. I or II; 3 hours, or ½ unit. Prerequisite: Anthropology 107; junior standing.

SPANISH AND ITALIAN

(Including Portuguese)

SPANISH

Students doing graduate work for an advanced degree in Spanish must acquire a practical command of the language. Some knowledge of Italian or Portuguese is recommended. A considerable amount of parallel training in one or more other languages or literatures such as English, French, German, Greek, or Latin, is indispensable. In any case, some Latin is required of candidates for the Doctor of Philosophy degree, a reading knowledge of simple Latin prose being the desirable minimum.

Candidates for the degree of Master of Arts in the Teaching of Spanish must earn four units in Spanish, two units in education, and two units in electives. Requirements are Spanish (middle group courses, 1 to 2 units; graduate courses, 2 to 3 units), 4 units; Education 400, Educational Philosophy, or Education 302, History of American Education, 1 unit; and Education 409, Advanced Educational

Psychology, 1 unit. The courses in Spanish and the electives must be selected with the approval of the advisor. The electives may be in Spanish, in education, or, in exceptional cases, in other fields. The advisor for candidates for this degree is Professor Arthur Hamilton, 218 Lincoln Hall.

Graduate Teaching Faculty

Professors: J. Van Horne (Head of Department), A. Hamilton, M. L. Wagner (Visiting).

Associate Professors: H. R. Kahane, R. P. Oliver.

Assistant Professors: J. H. D. Allen, A. Cantón, J. S. Flores, G. M. Moser, Angelina R. Pietrangeli.

Instructor: Concha Zardoya (Visiting).

Courses for Graduates

411. Spanish Literature in the Middle Ages. I; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Van Horne.

412. Spanish Literature in the Middle Ages. II; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Van Horne.

413. Contemporary Literature. Twentieth century writings in Spain and Spanish America. I; 1 unit. Mr. Van Horne, Miss Zardoya.

414. Contemporary Literature. Twentieth century writings in Spain and Spanish America. II; 1 unit. Mr. Van Horne, Miss Zardoya.

415. Spanish Literature in the Sixteenth Century. I; 1 unit. Offered in 1950-1951 and in alternate years. Mr. Van Horne.

416. Spanish Literature in the Sixteenth Century. II; 1 unit. Offered in 1950-1951 and in alternate years. Mr. Van Horne.

417. Seventeenth Century Literature. I; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Oliver.

418. Seventeenth Century Literature. II; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Oliver.

419. Spanish Literature of the Golden Age. Special problems in the literature of the Golden Age. S; 1 unit. Mr. Kahane.

421. Modern Spanish and Spanish American Novel. I; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Moser.

422. Modern Spanish and Spanish American Novel. II; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Moser.

431. Latin American Literature. I; 1 unit. Offered in 1949-1950 and in alternate years. Mr. Allen.

432. Latin American Literature. II; 1 unit. Offered in 1949-1950 and in alternate years. Mr. Allen.

451. Seminar in Spanish Linguistics. Research work in Castilian and Latin American linguistics. I; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Kahane, Mr. Wagner.

452. Seminar in Spanish Linguistics. Research work in Castilian and Latin American linguistics. II; 1 unit. Offered in 1948-1949 and in alternate years. Mr. Kahane.

453. Old Spanish. I; 1 unit. Offered in 1949-1950 and in alternate years. Mr. Kahane.

454. Old Spanish. II; 1 unit. Offered in 1949-1950 and in alternate years. Mr. Kahane.

491. Seminar (Thesis Course). Research work in special topics. I; 1 to 4 units. Mr. Hamilton, Mr. Kahane, Mr. Oliver, Mr. Van Horne, Mr. Wagner.

492. Seminar (Thesis Course). Research work in special topics. II; 1 to 4 units. Mr. Hamilton, Mr. Kahane, Mr. Oliver, Mr. Van Horne.

Courses for Graduates and Advanced Undergraduates

301. Survey of Spanish Literature. I; 3 hours, or ½ unit. Prerequisite: Spanish 202, or equivalent. Mr. Flores.

302. Survey of Spanish Literature. II; 3 hours, or ½ unit. Prerequisite: Spanish 202. Mr. Flores.

303. Survey of Latin American Literature. I, II; 3 hours, or ½ unit. Prerequisite: Spanish 202, or equivalent. Mr. Cantón, Mr. Moser.

304. Survey of Latin American Literature. I, II; 3 hours, or ½ unit. Prerequisite: Spanish 202, or equivalent. Mr. Cantón, Mr. Moser.

311. Cervantes: Don Quixote. I, II; 2 hours, or ½ unit. Prerequisite: Spanish 202, or equivalent. Offered in 1949-1950 and in alternate years.

312. Cervantes: Don Quixote. I, II; 2 hours, or ½ unit. Prerequisite: Spanish 202, or equivalent. Offered in 1949-1950 and in alternate years.

313. Classical Spanish Drama. I; 2 hours, or ½ unit. Prerequisite: Spanish 202, or equivalent. Offered in 1948-1949 and in alternate years. Mr. Oliver.

314. Classical Spanish Drama. II; 2 hours, or ½ unit. Prerequisite: Spanish 202, or equivalent. Offered in 1948-1949 and in alternate years. Mr. Oliver.

321. Modern Spanish and Spanish American Drama. I; 2 hours, or ½ unit. Prerequisite: Spanish 202, or equivalent. Mr. Hamilton.

322. Modern Spanish and Spanish American Drama. II; 2 hours, or ½ unit. Prerequisite: Spanish 202, or equivalent. Mr. Hamilton.

323. Modern Spanish and Spanish American Novel. Nineteenth and twentieth century novels of Spain. I; 3 hours, or ½ unit. Prerequisite: Spanish 202, or equivalent. Mr. Hamilton.

324. Modern Spanish and Spanish American Novel. Nineteenth and twentieth century novels of Spanish America. II; 3 hours, or ½ unit. Prerequisite: Spanish 202, or equivalent. Mr. Hamilton.

325. Lyric Poetry. Spanish and Spanish American lyrics. I; 2 hours, or ½ unit. Prerequisite: Spanish 202, or equivalent. Offered in 1950-1951 and in alternate years. Mr. Allen.

326. Lyric Poetry. Spanish and Spanish American lyrics. II; 2 hours, or ½ unit. Prerequisite: Spanish 325. Offered in 1950-1951 and in alternate years. Mr. Allen.

331. La Cultura Hispánica: España. I; 2 hours, or ½ unit. Mr. Van Horne.

332. La Cultura Hispánica: America Hispana. II; 2 hours, or ½ unit. Mr. Van Horne.

351. Phonetics. I; 2 hours, or ½ unit. Required for teacher-training majors in Spanish. Prerequisite: Spanish 202, or equivalent. Mr. Flores, Mr. Kahane.

352. Syntax. II; 2 hours, or ½ unit. Required for teacher-training majors in Spanish. Prerequisite: Spanish 202, or equivalent. Mr. Kahane.

ITALIAN

Students doing graduate work for an advanced degree in Italian must acquire a practical command of the language. Some knowledge of Spanish is recommended. A considerable amount of parallel training in one or more other languages or literatures such as English, French, German, Greek, Latin, or Portuguese, is indispensable. In any case, some Latin is required of candidates for the Doctor of Philosophy degree, a reading knowledge of simple Latin prose being the desirable minimum.

Courses for Graduates

411. Italian Literature in the Middle Ages: Petrarch and Boccaccio. I; 1 unit. Offered in 1950-1951 and in alternate years. Mr. Oliver.

412. Italian Literature in the Middle Ages: Petrarch and Boccaccio. II; 1 unit. Offered in 1950-1951 and in alternate years. Mr. Oliver.

415. Italian Literature of the Renaissance. I; 1 unit. Offered in 1949-1950 and in alternate years. Mr. Oliver.

416. Italian Literature of the Renaissance. II; 1 unit. Offered in 1949-1950 and in alternate years. Mr. Oliver.

451. Seminar in Italian Linguistics. I; 1 unit. Mr. Wagner.

452. Seminar in Italian Linguistics. II; 1 unit. Mr. Kahane.

491. Seminar (Thesis Course). Research in special topics. I; 1 to 4 units. Mr. Kahane, Mr. Oliver, Mr. Van Horne, Mr. Wagner.

492. Seminar (Thesis Course). Research in special topics. II; 1 to 4 units. Mr. Kahane, Mr. Oliver, Mr. Van Horne.

Courses for Graduates and Advanced Undergraduates

311. Dante: La Divina Commedia. I; 2 hours, or ½ unit. Prerequisite: Italian 101 and 102. Italian 103 and 104 are optional, but desirable. Miss Pietrangeli.

312. Dante: La Divina Commedia. Continuation of Italian 311. II; 2 hours, or ½ unit. Prerequisite: Italian 101 and 102. Italian 103 and 104 are optional, but desirable. Miss Pietrangeli.

321. Modern Italian Literature. I; 2 hours, or ½ unit. Prerequisite: Italian 101 and 102. Italian 103 and 104 are optional, but desirable. Mr. Van Horne.

322. Modern Italian Literature. II; 2 hours, or ½ unit. Prerequisite: Italian 101 and 102. Italian 103 and 104 are optional, but desirable. Mr. Van Horne.

PORTUGUESE

Courses for Graduates

491. Seminar. Research in special topics. I; 1 to 4 units. Mr. Allen, Mr. Moser, Mr. Wagner.

492. Seminar. Research in special topics. II; 1 to 4 units. Mr. Allen, Mr. Moser.

Courses for Graduates and Advanced Undergraduates

301. Introduction to Brazilian Literature. Survey of the contemporary Brazilian novel. I; 3 hours, or ½ unit. Prerequisite: Portuguese 101 and 102. Portuguese 103 and 104 are optional, but desirable. Mr. Allen.

302. Introduction to Portuguese Literature. Survey of the Golden Age of Portuguese. II; 3 hours, or ½ unit. Prerequisite: Portuguese 101 and 102. Portuguese 103 and 104 are optional, but desirable. Mr. Allen.

SPEECH

The Department of Speech offers the degrees of Master of Arts, Master of Science, and Doctor of Philosophy.

For the degree of Master of Arts, students may concentrate in one of these areas: general speech, public address, theater, oral interpretation, speech science, speech and hearing disorders. They may also elect a special curriculum in the teaching of speech.

For the degree of Master of Science, students may take a special curriculum in speech correction.

For the degree of Doctor of Philosophy, students may exercise either of two options: rhetoric and public address; the theater.

In addition to the general regulations of the Graduate College with respect to entrance, distribution of credits, examinations, and theses, the Department of Speech specifies the following requirements listed below:

Degree of Master of Arts. The entering student should present the equivalent of sixteen hours of undergraduate work in speech. If he does not present sixteen hours of credit in speech, he must make up the deficiency before he can be regarded as a candidate for a graduate degree. His record should include these courses or their equivalents: voice and diction or fundamentals of speech, oral interpretation, an elementary course in phonetics, an elementary course in the theater, and an advanced course in public speaking or discussion.

In consultation with the head of the department, the candidate chooses an advisor with whom he should confer about all details of his program.

A normal program of study requires eight graduate units (four each semester) for graduation. The student with a well-rounded undergraduate education may

take all eight units in speech; other students are expected to declare a major in speech (to consist of at least four units) and one or two minors in related fields of study outside the department. As a rule, a minor will not exceed two units.

Whether or not a thesis is presented depends upon the candidate's educational and professional aims. After consultation with the student, the student's advisor and the Department's Graduate Committee will decide in each case whether a thesis should be submitted as part of the degree requirements. Students who expect to go on to a doctor's degree will as a rule be required to present a thesis.

A final, written examination will be required of all candidates. In some cases an oral examination is also stipulated. The examination covers in part the general field in speech and in part the candidate's area of specialization.

Although no reading knowledge of a foreign language is stipulated for the master's degree, students who expect to do further graduate study should become familiar with the language requirements for the doctor's degree.

Degree of Master of Arts in the Teaching of Speech. Candidates for the Master of Arts degree who are interested in public school teaching should meet the following requirements:

(a) In the area of rhetoric and public address:
  (1) Speech, 3 units, including Speech 321, 322, 411 or 412, 423.
  (2) Education, 2 units, including Education 400, Philosophy of Education, or Education 302, History of American Education; and Education 409, Advanced Educational Psychology.
  (3) Electives, 3 units.

(b) In the area of the theater:
  (1) Speech, 4 units, including Speech 361 or 362 or 366, 352, 451, 452.
  (2) Education, 2 units, including Education 400, Philosophy of Education, or Education 302, History of American Education; and Education 409, Advanced Educational Psychology.
  (3) Electives, 2 units.

Degree of Master of Science in Speech Correction. The degree of Master of Science is granted for completion of a curriculum designed primarily for teachers in speech correction. For graduate standing in the curriculum the following prerequisites are necessary: fourteen hours of speech, including courses in lip reading, speech correction, and clinical practice; courses in general psychology, child psychology, and clinical psychology; eight hours of physiology, including a course in the physiology of the nervous system and the special senses; courses in education sufficient to meet requirements for an Illinois Teacher's certificate.

Candidates for the degree must earn eight units as follows:

(a) Speech, 4 units, including Speech 488, 489, 493.

(b) Education, 2 units, including Education 400, Philosophy of Education, or Education 302, History of American Education; Education 409, Advanced Educational Psychology.

(c) Physiology, ½ to 1 unit, chosen from the following: Physiology 306, Advanced Mammalian Physiology; Physiology 363, Endocrinology.

(d) Psychology, ½ to 1 unit, chosen from the following: Psychology 465, Practice in Psychological Testing; Psychology 360, Psychology of Exceptional Children; Psychology 404, Physiological Psychology; Psychology 412, Advanced Child Psychology; Psychology 471, Psychological Counseling and Psychotherapy.

Degree of Doctor of Philosophy. Students will be accepted as candidates for the doctor's degree who present either a well-rounded undergraduate education with at least sixteen hours of credit in speech or who hold a master's degree from an accredited institution. The doctoral candidate, like the master's candidate, plans his program in consultation with a departmental advisor.

For the student not holding an advanced degree, twenty-four graduate units are required; for the student who holds an advanced degree, sixteen graduate units must be completed. Although the majority of the units are taken within the Department, each candidate must choose at least one minor subject outside the Department to consist of not less than four units. The candidate may choose two minor subjects, and in that case the second minor consists of not less than two units. If two minors are selected one must be closely related to the student's area of emphasis. With the approval of the advisor and the Dean of the Graduate College the second minor may represent a division of the major field of study.

All candidates for the doctor's degree are required to present a thesis which will count for no more than eight graduate units.

At the end of the second year of graduate study, the candidate must pass a preliminary examination. This examination is written; it covers the student's area of specialization and the areas of knowledge represented by the candidate's graduate program. The final examination, after completion of the thesis, is oral and is for the most part restricted to the research represented by the thesis.

A reading knowledge of two foreign languages, usually French and German, is required of all candidates. The examination in one of the languages must have been satisfactorily passed before a candidate starts on his second year of study. If relevant to the student's graduate program, Latin or Greek may be substituted for French or German.

Graduate Teaching Faculty

Professors: K. R. Wallace (Head of Department), G. Fairbanks, B. Hewitt, W. M. Parrish.

Associate Professors: E. T. Curry, R. Murphy, Severina E. Nelson, A. Sundgaard, W. Swanson.

Assistant Professors: O. A. Dieter, Marie K. Hochmuth, L. S. Hultzén, C. B. Owens, C. H. Shattuck, G. J. Taylor, K. A. Windesheim.

Courses for Graduates

411. Greek Rhetoric and Oratory, 500 to 300 B.C. Study of rhetorical theories and selected speeches available in English, and correlation of theory and practice. Early development of the art of rhetoric; relation of rhetorical theories to practice as exemplified in selected speeches. I; 1 unit. Mr. Hultzén.

412. Roman Rhetoric and Oratory. Study of Roman rhetorical theory and practice from Hermagoras to Quintillian (ca. 100 B.C. to 200 A.D.). II; 1 unit. Mr. Dieter.

423. The Rhetoric of Aristotle. Study of the rhetoric in relation to other works of Aristotle. I; 1 unit. Mr. Parrish.

424. Medieval and Renaissance Rhetoric and Oratory. Study of rhetorical theory and practice in medieval and Renaissance times. II; 1 unit. Mr. Dieter.

436. Seminar in Public Discussion. Investigation of special problems in public discussion. II; 1 unit. Prerequisite: Speech 213. Mr. Murphy.

438. Seminar in Rhetorical Theory. Study of special topics in the history of rhetorical theory. II; 1 unit. Prerequisite: At least one graduate course in rhetoric and oratory. Mr. Wallace.

451. Problems in Play Directing in the School Theater. Study of the audience, play selection, the actor's abilities and needs, try-outs and casting, conduct of rehearsals and methods of directing, the dramatic club, contests and festivals. I; 1 unit. Mr. Swanson.

452. Problems in Play Production in the School Theater. Study of the school auditoria and stages, stage machinery and equipment and their use, lighting facilities and their use, organization of backstage crews, scene shifting and stage management, production problems of special types of plays. II; 1 unit. Mr. Swanson.

465. Seminar in Theater Art. Studies in the aesthetics of the theater. I; 1 to 2 units. Mr. Hewitt.

468. Seminar in Theater History. Studies in the history of the theater. II; 1 to 2 units. Mr. Hewitt.

471. Electroacoustics of Speech. The application of acoustical and electrical principles to the analysis of speech. Lectures, demonstrations, and laboratory work. I, II; 1 unit. Prerequisite: Speech 375 and 376. Mr. Curry.

475. Experimental Phonetics. Principles of experimental investigation of the physiological aspects of speech and hearing. Survey of the theoretical and experimental literature. Demonstration and experimental work in the speech laboratory. I; 1 unit. Prerequisite: Speech 376. Mr. Fairbanks.

476. Experimental Phonetics. Principles of experimental investigation of the acoustical and psychophysical aspects of speech and hearing. Survey of the theoretical and experimental literature. Demonstration and experimental work in the speech laboratory. II; 1 unit. Prerequisite: Speech 475. Mr. Fairbanks.

478. Seminar in Experimental Phonetics. Advanced consideration of experimental research in the physiological, acoustical, and psychophysical aspects of speech and hearing. Extensive survey of current literature. S; 1 unit. Prerequisite: Speech 475 and 476, or consent of instructor. Mr. Fairbanks.

488. Diagnosis of Speech Disorders. Study of diagnostic procedures used in analysis of symptoms involved in speech disorders. II; 1 unit. Miss Nelson.

489. Seminar in Speech Correction. Investigation of research trends in speech correction, including corrective procedures associated with speech rehabilitation. I, II; 1 to 2 units. Miss Nelson.

493. Research in Special Topics. I; 1 to 3 units. Mr. Curry, Mr. Dieter, Mr. Fairbanks, Mr. Hewitt, Miss Hochmuth, Mr. Hultzén, Mr. Murphy,

Miss Nelson, Mr. Owens, Mr. Parrish, Mr. Shattuck, Mr. Swanson, Mr. Taylor, Mr. Wallace, Mr. Windesheim.

494. Research in Special Topics. II; 1 to 3 units. Mr. Curry, Mr. Dieter, Mr. Fairbanks, Mr. Hewitt, Miss Hochmuth, Mr. Hultzén, Mr. Murphy, Miss Nelson, Mr. Owens, Mr. Parrish, Mr. Shattuck, Mr. Swanson, Mr. Taylor, Mr. Wallace, Mr. Windesheim.

Courses for Graduates and Advanced Undergraduates

301. Introduction to Phonetics. Basic principles of phonetic study, including observation and representation of pronunciation; ear training; practice in transcription. I, II; 3 hours, or ¼ to 1 unit. Prerequisite: Junior standing. Mr. Parrish, Mr. Hultzén.

311. British Public Address. Study of representative British speakers from the sixteenth century to the present. Lectures, reports, and papers. I; 3 hours, or ½ to 1 unit. Prerequisite: Speech 117 or 221; junior standing. Mr. Owens.

312. American Public Address. Study of representative American speeches from the sixteenth century to the present. II; 3 hours, or ½ to 1 unit. Prerequisite: Speech 117 or 221. Miss Hochmuth.

321. Modern Rhetorical Theory, 1700 to 1890. A consideration of the significant movements in the development of rhetorical theory in England, France, and America, from 1700 to 1890. I; 3 hours, or ½ to 1 unit. Prerequisite: Senior standing. Miss Hochmuth.

322. Modern Rhetorical Theory, 1890 to the Present. A consideration of the significant movements in the development of rhetorical theory in England, France, and America from 1890 to the present. II; 3 hours, or ½ to 1 unit. Prerequisite: Senior standing. Miss Hochmuth.

342. Advanced Interpretation. Oral interpretation of poetry. II; 3 hours, or ¼ to 1 unit. Prerequisite: Junior standing; Speech 141. Mr. Parrish.

352. Theories of Play Production. Origins and development of modern theatrical production: a critical examination of contemporary ideas and practices in theater architecture, acting, directing, and staging. II; 3 hours, or ½ to 1 unit. Mr. Hewitt.

361. History of the European Theater to the Renaissance. The theater and the theater arts of ancient and of medieval Europe. I; 3 hours, or ¼ to 1 unit. Prerequisite: Junior standing. Mr. Shattuck.

362. History of the European Theater from the Renaissance to 1900. The European theater and the theater arts from 1576 to 1900, with special reference to the English theater. II; 3 hours, or ¼ to 1 unit. Prerequisite: Junior standing. Mr. Shattuck.

363. Advanced Playwriting. Application of principles of dramatic form and structure to the more complex problems of playwriting. Practice in writing the full-length play. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Speech 263; consent of instructor.

366. Development of the American Theater. The development of the theater

and theater arts in America from colonial times to the beginning of the twentieth century. II; 3 hours, or ¼ to 1 unit. Prerequisite: Junior standing. Mr. Hewitt.

371. History and Principles of Literary and Rhetorical Criticism: Aristotle to Sidney. Same as English 371. I; 3 hours, or ½ to 1 unit. Prerequisite: Senior standing. Mr. Herrick.

372. History and Principles of Literary and Rhetorical Criticism: Sidney to the Present. Same as English 372. II; 3 hours, or 1 unit. Prerequisite: Senior standing. Mr. Herrick.

375. Speech Science. Introduction to anatomical and physiological characteristics of the normal speech mechanism. Demonstration in the speech laboratory. I; 3 hours, or ½ to 1 unit. Prerequisite: Ten hours of speech; senior standing, or consent of instructor. Mr. Fairbanks.

376. Speech Science. Introduction to the acoustical characteristics of voice and speech sounds and to the physiology of the ear. Demonstration in the speech laboratory. II; 3 hours, or ½ to 1 unit. Prerequisite: Speech 375. Mr. Fairbanks.

385. Speech Correction. Study of the causes, symptoms, and treatment of speech disorders, including articulatory vocal and rhythmical disorders; observation and practice in clinical techniques are provided in the laboratory. I, 4 hours, or ½ to 1 unit. Prerequisite: Ten hours of speech, senior standing, or consent of instructor. Miss Nelson.

386. Clinical Practice. Case work and practice teaching in remedial speech. Must be taken concurrently with Speech 385. I; 1 to 3 hours, or ½ unit. Miss Nelson and staff.

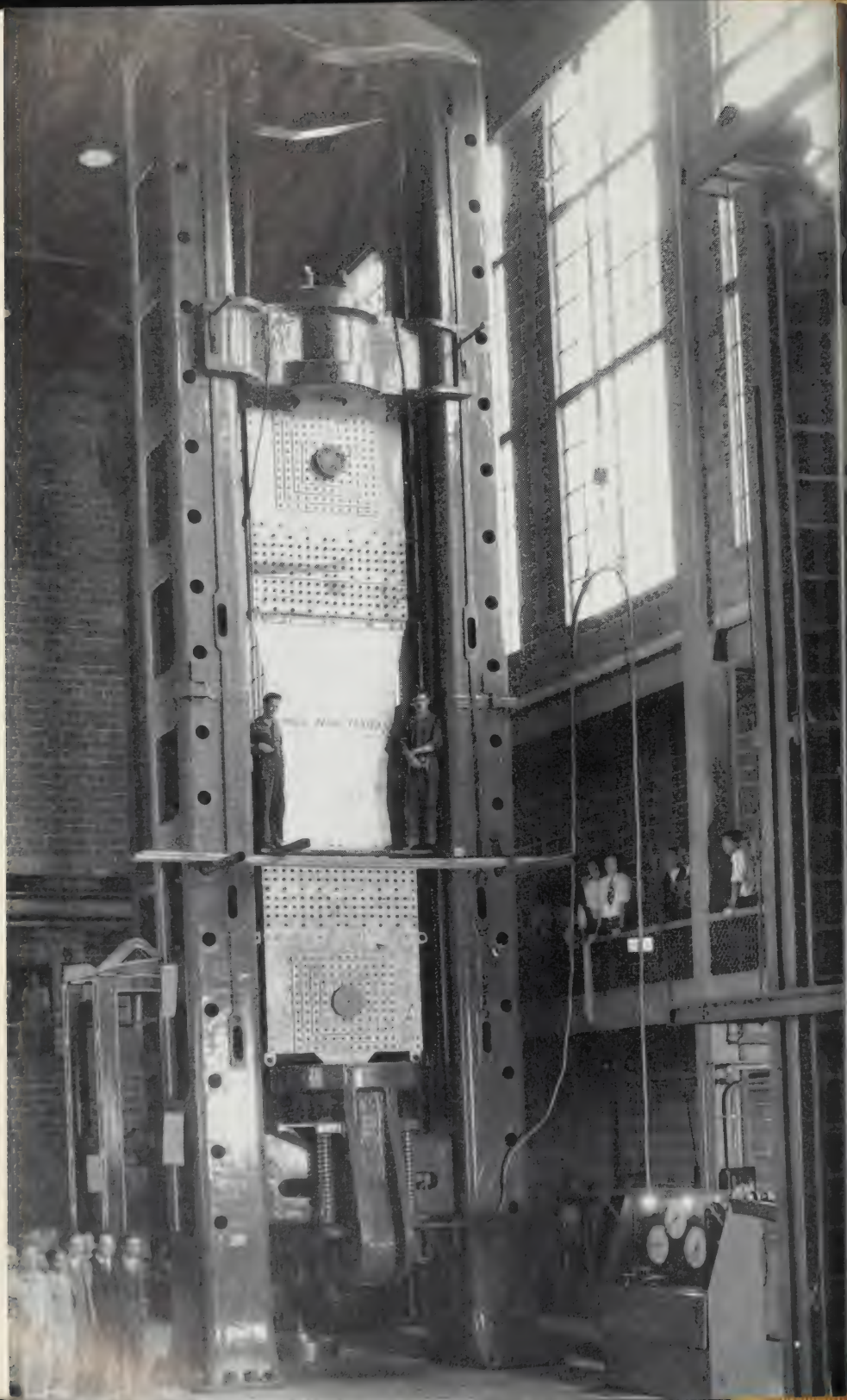
388. Speech Correction. Study of causes, symptoms, and treatment of speech disorders, including stuttering, cerebral palsy, aphasia, and glandular disorders. II; 4 hours, or ½ unit. Prerequisite: Speech 385. Miss Nelson.

389. Clinical Practice. Case work and practice teaching in remedial speech. Must be taken concurrently with Speech 388. II; 1 to 3 hours, or ½ unit. Miss Nelson and staff.

391. Introduction to Hearing Disorders. Analysis of symptoms and causes of hearing losses; effects of hearing loss upon oral communication, education, and psychological adjustment; principles of retraining the hard-of-hearing. I, II; 3 hours, or ¼ to ½ unit. Prerequisite: Ten hours of speech; Speech 301; junior standing, or consent of instructor. Mr. Taylor.

393. Aural Rehabilitation. Principles and methods of clinical and classroom retraining of the hard-of-hearing, including lip reading, auditory training, speech correction and conservation, counseling; clinical and classroom practice with children and adults. I, II; 3 hours, or ¼ to ½ unit. Prerequisite: Speech 391; senior standing, or consent of instructor. Required in the curriculum of teacher training in speech correction. Mr. Taylor.

395. Audiometry and the Use of Hearing Aids. Selective and diagnostic tests of hearing, the planning and conduct of hearing conservation programs, general problems involved in the use of hearing aids. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Speech 376. Mr. Curry, Mr. Taylor.



THEORETICAL AND APPLIED MECHANICS

The Department of Theoretical and Applied Mechanics offers graduate work leading to the degrees of Master of Science in Theoretical and Applied Mechanics and Doctor of Philosophy in Engineering. Graduate students electing theoretical and applied mechanics as their major must have had the equivalent of the undergraduate courses required for a bachelor's degree in any of the curricula in the College of Engineering.

In graduate work in the field of theoretical and applied mechanics emphasis is given mainly to the following topics: analytical and experimental methods of analysis of engineering problems; a study of the properties of materials and of the elastic and inelastic behavior of load-resisting members; a study of hydraulics and mechanics of fluids of various degrees of turbulence; and mechanical vibrations and other problems in the dynamics of bodies. Research is emphasized in the graduate work.

Extensive research programs are conducted by the Department of Theoretical and Applied Mechanics in special laboratories which are available for use by graduate students. These laboratories provide facilities for studies of fatigue of metals; stresses in railway rails and car wheels; creep properties and other inelastic behavior of materials; photoelastic, electric strain gage, and other methods of experimental stress analysis; constant humidity-temperature tests of plastics; reinforced concrete structures; static and dynamic tests of materials; vibrations of machines and structures; hydraulics and fluid mechanics, etc.

Some undergraduate courses offered to junior and senior students may be taken for minor credit by graduate students whose majors are in other departments.

Graduate Teaching Faculty

Professors: F. B. Seely (Head of Department), T. J. Dolan, A. M. Freudenthal, W. M. Lansford, N. O. Myklestad, F. E. Richart, H. J. Schrader, W. L. Schwalbe.

Associate Professors: W. L. Collins, W. N. Findley, H. L. Langhaar, J. O. Smith.

Assistant Professors: W. E. Black, P. G. Jones.

Courses for Graduates

421. Mechanics of Materials. Methods of obtaining relations between loads and stresses and strains in various members. The main topics covered in this course and the one which follows are: curved beams, unsymmetrical bending, thick-walled cylinders, beams on elastic supports, contact stresses, torsion of members with non-circular cross-section, stress concentrations, elastic energy methods applied to statically indeterminate members, flat plates, inelastic behavior of various types of members. Introduction to mathematical theory of elasticity; elastic and plastic buckling; criteria of failure by yielding and by fracture. I; ½ to 1 unit. Mr. Smith.

422. Mechanics of Materials. Continuation of Theoretical and Applied Mechanics 421. II; 1 unit. Prerequisite: Theoretical and Applied Mechanics 421. Mr. Smith.

Laboratory Has the Nation's Second Largest Testing Machine,
e of Exerting 3,000,000 Pounds of Force

424. Properties of Engineering Materials. Significance of properties under various conditions of loading and use, including static, creep and fatigue, and impact properties; tests and interpretation of test data. Methods of obtaining special combinations of properties. Effects of temperature, strain rate, internal structure, etc. Specifications of properties and materials. II; ½ to 1 unit. Mr. Collins.

427. Analytical Study of Experimental Work in Reinforced Concrete. A critical study of available results of tests of reinforced concrete members and structures, with particular attention to beams, frames and footings. I; 1 unit. Prerequisite: Introductory course in reinforced concrete. Mr. Richart.

428. Analytical Study of Experimental Work in Reinforced Concrete. Continuation of Theoretical and Applied Mechanics 427, with particular attention to columns and slabs. II; 1 unit. Prerequisite: Introductory course in reinforced concrete. Mr. Richart.

431. Fluid Mechanics. Modern fluid dynamics including dimensional analysis. The concept of vorticity, stress-strain relations in a viscous fluid, Navier-Stokes equations, and the momentum principle. Applications to the boundary layer flow, laminar flow and flow in conduits. I; 1 unit. Prerequisite: Theoretical and Applied Mechanics 232 and 234; Theoretical and Applied Mechanics 334 and one or more advanced mathematics courses are desirable. Mr. Langhaar.

451. Theory of Elasticity with Application to Engineering Problems. A study of the mechanics of elastic deformable bodies, based on the fundamental concepts of equilibrium, geometry of strain and properties of materials. Relations between stresses, strains, and displacements are studied in detail with special consideration given to their significance in engineering problems. I; 1 unit. Mr. Myklestad, Mr. Newmark.

452. Theory of Elasticity with Application to Engineering Problems. Continuation of Theoretical and Applied Mechanics 451. II; 1 unit. Prerequisite: Theoretical and Applied Mechanics 451. Mr. Myklestad, Mr. Newmark.

461. Inelastic Behavior of Engineering Materials. An outline of a general theory of inelastic behavior. A study of the mechanisms of inelastic action involving viscosity, plasticity, and fracture in relation to yielding or flow, creep, fracture under repeated loads and under impact. Relation of inelastic behavior to planning of tests, to the interpretation of test results and to design. I; ½ to 1 unit. Prerequisite: One year of graduate work. Mr. Freudenthal, Mr. Langhaar.

462. Inelastic Behavior of Engineering Materials. Continuation of Theoretical and Applied Mechanics 461. II; 1 unit. Prerequisite: Theoretical and Applied Mechanics 461. Mr. Freudenthal, Mr. Langhaar.

491. Thesis. I; 1 to 2½ units. Staff.

492. Thesis. II; 1 to 2½ units. Staff.

493. Special Problems. Individual investigation of studies, either analytical or

experimental, in one or more phases of theoretical and applied mechanics, including mechanics of materials, theory of elasticity, properties of materials, mechanical vibrations, hydraulics and fluid mechanics, etc. I; ½ to 2 units. STAFF.

494. SPECIAL PROBLEMS. Individual investigation of studies, either analytical or experimental, in one or more phases of theoretical and applied mechanics, including mechanics of materials, theory of elasticity, properties of materials, mechanical vibrations, hydraulics and fluid mechanics, etc. II; ½ to 2 units. STAFF.

Courses for Graduates and Advanced Undergraduates

311. MECHANICAL VIBRATIONS. Kinematics of vibratory motion. Comprehensive study of motion having single degree of freedom. Critical speeds of shafts; vibration of systems with several degrees of freedom. Applications to engineering problems. I; 3 hours, or ½ to 1 unit. Prerequisite: Theoretical and Applied Mechanics 154 or 156 or 211 and 221. MR. JONES, MR. MYKLESTAD.

312. MECHANICAL VIBRATIONS. Continuation of Theoretical and Applied Mechanics 311. Problems in bending and torsional vibrations. Special problems. II; 3 hours, or ½ to 1 unit. Prerequisite: Theoretical and Applied Mechanics 311. MR. MYKLESTAD.

321. ADVANCED MECHANICS OF MATERIALS. Methods used in elementary mechanics of materials are expanded and generalized and used to solve more complex problems. Thick-walled cylinders, torsion of bar having non-circular cross-section; curved beams, unsymmetrical bending, flat plates; theories of failure. I; 3 hours, or ½ to 1 unit. Prerequisite: Theoretical and Applied Mechanics 221 and 223. MR. BLACK, MR. SMITH.

323. ADVANCED LABORATORY IN MATERIALS TESTINGS. Calibration of testing machines and of strain measuring instruments. Use of various mechanical and electrical strain gages. Interpretation of test results. Relation of tests to specifications of materials. I, II; 3 hours, or ½ to 1 unit. Prerequisite: Theoretical and Applied Mechanics 221 and 223. MR. COLLINS, MR. PUTNAM.

334. FLUID MECHANICS AND ADVANCED HYDRAULICS. A study of the basic properties of fluids in general, particularly those that influence the flow of fluids in pipes and open channels, viscosimetry, dimensional analysis, effect of boundary conditions, cavitation, water tunnel, hydraulic pump, water hammer, pumps, turbines. Some laboratory work. II; 3 hours, or ½ to 1 unit. Prerequisite: Theoretical and Applied Mechanics 232 and 234. MR. LANSFORD.

351. ENGINEERING ANALYSIS. Analytical, graphical, and approximate methods of solving equations common to engineering; curve fitting and empirical formulas; applications of infinite series, especially Fourier series, vector analysis, statistical analysis, etc. I; 3 hours, or ½ to 1 unit. Prerequisite: Theoretical and Applied Mechanics 154 or 156 or 211 and 221. MR. MYKLESTAD.

352. ENGINEERING ANALYSIS. Continuation of Theoretical and Applied Mechanics 351. II; 3 hours, or ½ to 1 unit. MR. MYKLESTAD.

VETERINARY PATHOLOGY AND HYGIENE

Graduate students who choose veterinary pathology and hygiene as a major must be graduates of a recognized veterinary college. Students whose major is in a related field may register for a minor in veterinary pathology and hygiene.

The Master of Science and Doctor of Philosophy degrees are offered in veterinary pathology and hygiene. Candidates for the master's degree must pass a reading knowledge examination in one foreign language in addition to satisfying the other requirements of the Graduate College for this degree.

Graduate Teaching Faculty

Professors: R. Graham (Head of Department), C. C. Morrill, J. Sampson, L. E. St. Clair.

Associate Professor: N. D. Levine.

Assistant Professor: Vera H. Grace.

Courses for Graduates

401. Laboratory Diagnostic Methods in Veterinary Pathology. Diagnosis of the animal diseases caused by bacteria, filtrable viruses, and fungi. I; 1 unit. Prerequisite: Bacteriology 326, or equivalent. Mr. Graham.

402. Laboratory Diagnostic Methods in Veterinary Pathology. Diagnosis of animal diseases caused by parasitic protozoa, helminths, arthropods, metabolic disturbances, and poisonous plants. II; 1 unit. Mrs. Grace, Mr. Levine, Mr. Sampson.

404. Seminar. Required of all graduate students whose major is veterinary pathology and hygiene. I, II; ¼ unit. Mr. Graham, Mr. Levine.

405. Advanced Veterinary Pathology. Advanced study of gross and microscopic pathology of diseases of domestic animals. I; 1 unit. Mr. Morrill.

406. The Experimental Method in Veterinary Research. Planning of experiments, use of controls, interpretation of results, sources of error, and writing the research report. Lectures and discussion. I; ¼ unit. Mr. Levine.

493. Research. Assigned problems of research in veterinary pathology, histology, physiology, parasitology, and bacteriology. I; ½ to 2 units. Mrs. Grace, Mr. Graham, Mr. Levine, Mr. Morrill, Mr. Sampson, Mr. St. Clair.

494. Research. Assigned problems of research in veterinary pathology, histology, physiology, parasitology, and bacteriology. II; ½ to 2 units. Mrs. Grace, Mr. Graham, Mr. Levine, Mr. Morrill, Mr. Sampson, Mr. St. Clair.

ZOOLOGY AND PHYSIOLOGY

The Department of Zoology and Physiology offers work leading to the Master of Science and Doctor of Philosophy degrees in Zoology and to the Master of Science degree in Physiology.

ZOOLOGY

Graduate students who choose zoology as a major must have had at least two years of undergraduate work in zoology, except that under special circumstances advanced courses in closely allied subjects may be accepted in place of the fourth semester of zoology. Graduate students in other departments who choose zoology as a minor must have had at least one year of undergraduate work in zoology or ten hours of any laboratory science.

A reading knowledge of German and French is indispensable for graduate study in zoology, and familiarity with Latin and Greek is of great advantage.

Graduate students whose major is zoology are strongly advised to study at least one summer at a marine biological station. Every candidate for the Doctor of Philosophy degree in zoology is required to furnish evidence of having completed satisfactorily at least six weeks of work at an approved station.

Although no special degree in wildlife management is offered, students may prepare themselves for that type of work by selecting courses from the following list: Zoology 304, 318, 321, 335, 336, 337, 338, 343, 345, 418, 421, 441, 445, 446, and research courses. Such students should choose their minors from botany, physiology, entomology, and bacteriology.

For a master's degree in the biological sciences, see page 53.

For the degree of Master of Science in the Teaching of the Biological Sciences and General Science, see page 53.

Graduate Teaching Faculty

Professors: F. B. Adamstone (Acting Head of Department), S. C. Kendeigh, R. R. Kudo, C. L. Prosser, F. R. Steggerda, L. J. Thomas, H. J. Van Cleave.

Associate Professors: B. V. Hall, L. Ingle, W. M. Luce, H. Quastler, A. B. Taylor.

Assistant Professors: H. I. Fisher, D. F. Hoffmeister, O. E. Kugler, M. R. Matteson, H. H. Shoemaker, H. M. Smith, V. J. Wulff.

Courses for Graduates

403. Cytology. Structure and organization of the animal cell. I; 1 unit. Prerequisite: Consent of instructor. Mr. Adamstone.

409. History of Zoology. The development of zoological science as a specialized field of human knowledge. I; ½ to 1 unit.

418. Advanced Protozoology. Detailed morphological, physiological, and developmental studies of human protozoa and certain other important forms; introduction to, and practice of, technique. II; 1 unit. Prerequisite: Zoology 318. Mr. Kudo.

419. Experimental Protozoology. Experimental methods for study of problems in growth, multiplication, nuclear phenomena, and regeneration in protozoa. I; ½ to 1 unit. Prerequisite: Zoology 418. Mr. Kudo.

422. Parasitology-Helminthology. Advanced study of modern methods in helminthology. II; 1 unit. Prerequisite: Zoology 321, or equivalent. Mr. Thomas.

424. Invertebrate Taxonomy. Individual problems in taxonomy of invertebrates. II; ½ to 1 unit. Prerequisite: Zoology 304. Offered in 1949-1950 and in alternate years. Mr. Matteson.

432. Classification, Phylogeny, and Evolution of Vertebrates. I; 1 unit. Prerequisite: Zoology 132; graduate standing in zoology. Offered in 1949-1950 and in alternate years. Mr. Hall, Mr. Smith.

433. General Embryology. I; 1 unit. Prerequisite: Zoology 333. Offered in 1948-1949 and in alternate years. Mr. Adamstone.

435. Advanced Ornithology. Seminar on modern techniques, concepts, and problems. I; ½ unit. Prerequisite: Zoology 335, or equivalent. Offered in 1948-1949 and in alternate years. Mr. Kendeigh.

441. Advanced Field Ecology. Field studies of ecological communities, mammals, birds, and invertebrates in (for example) Great Smoky Mountains National Park, Eastern Tennessee. S; ½ to 1 unit. Prerequisite: Graduate standing in zoology. Mr. Kendeigh.

445. Advanced Ecology and Wildlife Management. Seminar on modern techniques, concepts, and problems. I; ½ unit. Prerequisite: Zoology 345, or equivalent. Offered in 1949-1950 and in alternate years. Mr. Kendeigh.

446. Physiological Ecology. Physiological adjustments and responses of organisms to their environment. II; 1 unit. Prerequisite: Graduate standing in zoology. Mr. Kendeigh.

455. Advanced Genetics. The gene in heredity, development, and evolution. I; 1 unit. Prerequisite: Graduate standing in zoology. Mr. Luce.

456. Physiological Genetics. The nature of the gene and its action in the developmental and physiological processes of the organism. II; 1 unit. Prerequisite: Graduate standing in zoology. Mr. Luce.

462. Advanced General Physiology. Same as Physiology 462. Lectures, reports, and discussions. Topic, 1948: Electrophysiology; 1949: Permeability of Membranes and Active Transport. I or II; ½ unit. Prerequisite: Physiology 362, or equivalent. Mr. Prosser.

467. Experimental Embryology. II; 1 unit. Prerequisite: Zoology 333, or equivalent. Offered in 1948-1949 and in alternate years. Mr. Kugler.

493. Individual Research. I; 1 to 2 units.

494. Individual Research. II; 1 to 2 units.

Work in the following fields is offered for students registered in Zoology 493 or 494:

Animal Ecology, Ornithology, and Wildlife Management — Mr. Kendeigh.

Chemical Embryology — Mr. Kugler.

Genetics and Regeneration — Mr. Luce.

Herpetology — Mr. Smith.

Histology and Cytology — Mr. Adamstone.

Ichthyology and Fish Management — Mr. Shoemaker.

Invertebrate Zoology and Parasitology — Mr. Ingle, Mr. Matteson, Mr. Van Cleave.

Limnology — Mr. Matteson.

Mammalogy — Mr. Hoffmeister.

Ornithology and Avian Anatomy — Mr. Fisher.

Parasitology and Helminthology — Mr. Thomas.

Physiological Zoology — Mr. Prosser.

Protozoology and Parasitology — Mr. Kudo.

Vertebrate Embryology —

Vertebrate Zoology — Mr. Hall.

Courses for Graduates and Advanced Undergraduates

Note: Graduate students ordinarily receive ¼ unit credit in the following courses, but may receive ½ unit if extra work is done: 306, 334, 335, 336, 337, 338, 342, 343, 351, and 352. In Zoology 320 and 332, graduate students ordinarily receive ½ unit credit, but may receive 1 unit if extra work is done.

300. General Seminar. For members of the staff and graduate students. Also open to seniors whose major is zoology. I; no credit. Attention is called to the following special clubs and seminars, some of which are interdepartmental: Animal Ecology Club, Genetics Seminar.

301. General Seminar. For members of the staff and graduate students. Also open to seniors whose major is zoology. II; no credit. Attention is called to the following special clubs and seminars, some of which are interdepartmental: Animal Ecology Club, Genetics Seminar.

302. Individual Topics. For those who wish to study individual problems. Candidates for honors and undergraduates who are enrolled for tutorial work or in individual curricula should register in this course. Graduates may register for topics involving individual work not assigned in other courses. Laboratory, conferences, and readings. I; 2 to 5 hours, or ½ to 1 unit. Prerequisite: Two years of zoology; senior standing; approval of department. Staff.

303. Individual Topics. For those who wish to study individual problems. Candidates for honors and undergraduates who are enrolled for tutorial work or in individual curricula should register in this course. Graduates may register for topics involving individual work not assigned in other courses. Laboratory, conferences, and readings. II; 2 to 5 hours, or ½ to 1 unit. Prerequisite: Two years of zoology; senior standing; approval of department. Staff.

304. Field Zoology. Collection, preservation, and identification of lower vertebrates and fresh water invertebrates; habits and life histories of selected forms. I; 3 to 5 hours, or ½ to 1 unit. Prerequisite: One year of zoology, or equivalent; senior standing. Mr. Matteson.

306. Biology for Teachers. Same as Botany 306. A teacher-training and review course for those engaged in or preparing for teaching general biology in

high school. II; 2 hours, or ¼ unit. Prerequisite: Botany 100 and 101; Zoology 101; junior standing. Mr. Fuller, Mr. Matteson.

318. Protozoology. Morphology, taxonomy, physiology, and life history of representative free-living and parasitic protozoa. I; 5 hours, or 1 unit. Students who have received credit for Zoology 118 may not elect Zoology 318 for more than 3 hours credit. Prerequisite: One year of zoology, or equivalent; senior standing. Mr. Kudo.

320. Invertebrate Zoology. Invertebrates; structure and development. Application of biological principles. Specific and comparative morphology of the invertebrates; coordination of structure and function, origin, development, and life histories. II; 4 hours, or ½ unit. Prerequisite: Junior standing; Zoology 101. Mr. Ingle.

321. Parasitology — Helminthology. Worm parasites, life cycles, morphology, taxonomy, environmental relations. Lecture, laboratory, technic, readings, quiz, demonstrations, problems. I, II; 3 to 5 hours, or ½ to 1 unit. Prerequisite: Zoology 132; senior standing. Mr. Thomas.

332. Advanced Vertebrate Zoology. Vertebrate morphology: comparative anatomy, evolution and function of vertebrate organ systems, with special emphasis on the evolution, anatomy, and function of the skeletal and nervous systems. Lectures and laboratory. I; 4 hours, or ½ unit. Prerequisite: Zoology 333; junior standing. Offered in 1948-1949 and in alternate years. Mr. Hall.

333. Vertebrate Embryology. The development of the vertebrate body and its organs. I, II; 5 hours, or ½ unit. Prerequisite: Zoology 132; junior standing. Mr. Adamstone.

334. Vertebrate Histology. Study and preparation of tissues of the vertebrate body. II; 3 hours, or ¼ unit. Prerequisite: Zoology 333; junior standing, or consent of instructor. Mr. Adamstone.

335. Ornithology. Structure, functions, environmental relations, habits, life history, and identification of birds. II; 3 hours, or ¼ unit. Prerequisite: Zoology 101 or 104; junior standing. Mr. Kendeigh.

336. Mammalogy. Classification, distribution, life history, evolution, and identification of mammals. Lecture, laboratory, and field work. I; 3 hours, or ¼ unit. Prerequisite: Zoology 132; junior standing. Offered in alternate years; not given in 1948-1949. Mr. Hoffmeister.

337. Ichthyology. Classification, structure, evolution, distribution, and life history of fishes. Lectures, laboratory, and field work. I; 3 hours, or ¼ unit. Prerequisite: Zoology 132; junior standing. Offered in 1948-1949 and in alternate years. Mr. Shoemaker.

338. Herpetology. Classification, distribution, life history, and identification of reptiles and amphibia, particularly those of the United States. Lectures, laboratory, and field work. II; 3 hours, or ¼ unit. Prerequisite: Zoology 132; junior standing. Offered in 1949-1950 and in alternate years. Mr. Smith.

341. Field Ecology. Study of biotic communities, birds, and fish in the vicinity of Reelfoot Lake, Tennessee, covering six days. Students may enroll in subsequent years for additional credit by specializing in different fields of

study. II; 1 to 4 hours, or ¼ to 1 unit. Prerequisite: Enrollment in Zoology 240, or 335, or equivalent; junior standing. Mr. Kendeigh, Mr. Shoemaker.

342. Wildlife Management and Conservation. Size and measurement of animal population, factors affecting reproduction and mortality, life history, management policies for fishes, mammals, and birds. I; 3 hours, or ¼ unit. Prerequisite: Zoology 101 or 104; junior standing. Mr. Shoemaker.

343. Limnology. Study of the lake, pond, and river with emphasis on the physical environment as well as on the plants and animals which live in fresh water. Lectures, discussions, laboratory, and field work. II; 3 hours, or ¼ unit. Prerequisite: Zoology 101, or Botany 100 and 101; junior standing. Offered in 1948-1949 and in alternate years. Mr. Matteson.

345. Animal Ecology and Geography. Dynamics, development, and distribution of biotic communities. I; 3 to 5 hours, or ½ to 1 unit. Prerequisite: Senior standing; one year of zoology. Mr. Kendeigh.

351. Genetics. Principles of heredity. Lectures, readings, and discussions. II; 3 hours, or ¼ unit. Prerequisite: Zoology 101 or 104, or one semester of any biological science; junior standing. Mr. Luce.

352. Genetics. Laboratory experiments illustrating the principles of heredity, problems, demonstrations. II; 2 hours, or ¼ unit. Prerequisite: Credit or registration in Zoology 351; junior standing. Mr. Kitzmiller, Mr. Luce.

361. Comparative Physiology. Same as Physiology 361. A comparison of the general physiology of different groups of animals. I; 5 hours, or 1 unit. Prerequisite: Senior standing; three semesters of zoology, or two of zoology and one of physiology. Elementary physiology and chemistry recommended. Mr. Prosser.

362. Cellular Physiology. Same as Physiology 362. A physico-chemical analysis of biological functions common to most living cells. II; 5 hours, or 1 unit. Prerequisite: Senior standing; one year of biology; three semesters of chemistry. Elementary physics recommended. Mr. Prosser.

363. Endocrinology. Same as Physiology 363. The glands of internal secretion with special reference to the vertebrates. I; 3 hours, or ½ unit. Prerequisite: One semester of elementary zoology or physiology; Zoology 334, or organic chemistry; senior standing. Mr. Hall.

PHYSIOLOGY

The department offers graduate work leading to the degree of Master of Science in Physiology. Graduate students who choose physiology as a major must have at least two years of undergraduate work in physiology or physiological zoology, or three semesters in these studies in addition to biochemistry. Graduate students in other departments who choose physiology as a minor must have had at least one year of physiology or its equivalent or an undergraduate major in either chemistry or physics. A reading knowledge of German and French is required.

For a master's degree in the biological sciences, see page 53.

For the degree of Master of Science in the Teaching of the Biological Sciences and General Science, see page 53.

Courses for Graduates

453. Experimental Mammalian Physiology. A course to acquaint students with operative techniques that will be helpful in doing experimental mammalian physiology. II; 1 unit. Prerequisite: Consent of instructor. Mr. Steggerda.

454. Regulative Mechanisms in Behavior. Seminar in physiological aspects of regulative mechanisms and their reactions. I; ½ unit. Prerequisite: Consent of instructor.

462. Advanced General Physiology Seminar. Same as Zoology 462. Lectures, reports and discussions. Topic, 1948-1949: Electrophysiology; 1949-1950: Permeability of Membranes and Active Transport. I or II; ½ unit. Prerequisite: Physiology 362, or equivalent. Mr. Prosser.

491. Research. I; 1 to 2 units. Mr. Prosser, Mr. Steggerda, Mr. Taylor, Mr. Wulff.

492. Research. II; 1 to 2 units. Mr. Prosser, Mr. Steggerda, Mr. Taylor, Mr. Wulff.

495. Mammalian Physiology Seminar. Review of literature. I, II; ¼ unit. Mr. Steggerda.

Courses for Graduates and Advanced Undergraduates

305. Structure and Function of the Nervous System. An experimental approach to an understanding of nervous function. II; 5 hours, or ½ unit. Graduate students ordinarily receive ½ unit credit but may obtain 1 unit provided extra work is done. Prerequisite: One year of zoology or physiology; one year of physics. Mr. Wulff.

306. Advanced Mammalian Physiology. A review of topics on muscle, nerve, blood, and circulation pertaining to the field of mammalian physiology. I; 5 hours, or 1 unit. Prerequisite: Twenty hours of chemistry, or consent of instructor; senior standing. Mr. Steggerda, Mr. Stolpe, Mr. Wulff.

307. Advanced Mammalian Physiology. A review of respiration, digestion, metabolism, excretion, temperature regulation, and endocrinology. II; 5 hours, or 1 unit. Prerequisite: Twenty hours of chemistry, or consent of instructor; senior standing. Mr. Steggerda, Mr. Stolpe, Mr. Wulff.

361. Comparative Physiology. Same as Zoology 361. A comparison of the general physiology of different groups of animals. I; 5 hours, or 1 unit. Prerequisite: Senior standing; three semesters of zoology, or two of zoology and one of physiology. Elementary physiology and chemistry recommended. Mr. Prosser.

362. Cellular Physiology. Same as Zoology 362. A physico-chemical analysis of biological functions common to most living cells. II; 5 hours, or 1 unit. Prerequisite: Senior standing; one year of biology; three semesters of chemistry. Elementary physics recommended. Mr. Prosser.

363. Endocrinology. Same as Zoology 363. The glands of internal secretion with special reference to the vertebrates. I; 3 hours, or ½ unit. Prerequisite: One semester of elementary zoology or physiology; Zoology 334, or organic chemistry; senior standing. Mr. Hall.

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BULLETIN
UNIVERSITY OF ILLINOIS

GRADUATE COLLEGE

Urbana
Departments

1950
1952

UNIVERSITY OF ILLINOIS BULLETIN

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UNIVERSITY
OF
ILLINOIS

Urbana Departments

GRADUATE COLLEGE

1950-1952
BULLETIN

PUBLISHED BY THE UNIVERSITY
URBANA, 1950

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CONTENTS

Board of Trustees 2
Executive Faculty of the Graduate College 5
Calendar of the Graduate College 6
Heads of Departments and Chairmen of Committees
Administering Advanced Degrees 8
Admission 12
Registration and Program of Studies 14
The Master's Degree 17
The Degree of Doctor of Philosophy 20
Professional Degrees 24
Libraries 26
Fellowships 27
Assistantships 29
Fees and Expenses 30

Fields of Instruction

Aeronautical Engineering 33
Agricultural Economics 35
Agricultural Engineering 39
Agriculture 40
Agronomy 41
Animal Science 44
Animal Nutrition 46
Architecture 47
Art 49
Astronomy 51
Bacteriology 51
Biological Sciences 53
Botany 54
Business Organization and Operation 60
Accountancy 61
Business 63
Business Law 64
Commercial Teaching 64
Management 65
Marketing 66
Ceramic Engineering 69
Chemistry 71
Chemical Engineering 78
Civil Engineering 80
Classics 85
Greek 85
Latin 87
Communications, Mass 88
Dairy Science 91
Economics 94

Education 102
Electrical Engineering 118
English Language and Literature 126
English Literature 127
American Literature 130
Rhetoric and Composition 131
Entomology 131
Food Technology 134
Dairy Technology 137
French 138
Genetics 140
Geography 140
Geology 145
German 148
Government and Public Affairs 151
History 151
Home Economics 157
Horticulture 163
Humanities 165
Journalism and Communications 167
Labor and Industrial Relations 170
Landscape Architecture 174
Law 176
Library Science 176
Mathematics 182
Mechanical Engineering 188
Mining and Metallurgical Engineering 194
Music 199
Philosophy 205
Physical Education 207
Physical Sciences 211
Physico-Chemical Biology 212
Physics 213
Physiology 219
Plant Pathology 222
Political Science 224
Psychology 229
Social Sciences 235
Social Welfare Administration 236
Sociology and Anthropology 240
Spanish and Italian 243
Portuguese 247
Speech 247
Theoretical and Applied Mechanics 253
Veterinary Pathology and Hygiene 257
Zoology 258

THE GRADUATE COLLEGE
EXECUTIVE FACULTY
1950-1951

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President of the University

Louis Nicot Ridenour, Ph.D., Professor of Physics and Dean of the Graduate College

Andrew Conway Ivy, Ph.D., M.D., D.Sc., Distinguished Professor of Physiology, Head of the Department of Clinical Science, and Vice-President of the University in charge of the Chicago Professional Colleges

Howard Rothmann Bowen, Ph.D., Professor of Economics and Dean of the College of Commerce and Business Administration

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Robert Eugene Johnson, Ph.D., M.D., Professor of Physiology and Head of the Department of Physiology

Charles Mayard Kneier, Ph.D., J.D., Professor of Political Science and Chairman of the Department of Political Science

Charles Anthony Knudson, Ph.D., Professor of French

Norman Alwyn Parker, M.S., M.E., Professor of Mechanical Engineering and Head of the Department of Mechanical Engineering

Elmer Roberts, Ph.D., Professor of Animal Genetics

William Cumming Rose, Ph.D., D.Sc., Professor of Biochemistry

John Douglass Ryder, Ph.D., Professor of Electrical Engineering and Head of the Department of Electrical Engineering

Glenn Wade Salisbury, Ph.D., Professor of Dairy Science and Head of the Department of Dairy Science

Joseph Royall Smiley, Ph.D., Associate Professor of French and Associate Dean of the Graduate College

Allen Stuart Weller, Ph.D., Professor of Art and Head of the Department of Art

George Willard White, Ph.D., Professor of Geology and Head of the Department of Geology

CALENDAR

1950 Summer Session

June 23, Friday—June 24, Saturday	Graduate registration.
June 28, Wednesday	Instruction begins.
July 4, Tuesday	Independence Day. No classes.
July 8, Saturday Noon	Latest date to apply for French examination.
July 15, Saturday Noon	Latest date to apply for German examination.
July 21, Friday	French examination.
July 22, Saturday Noon	Latest date for dropping a course.
July 28, Friday	German examination.
August 12, Saturday Noon	No names will be added to the August graduation list after this date.
August 12, Saturday Noon	Latest date for candidates for the master's degree in August to deposit theses.
Aug. 18, Friday—Aug. 19, Saturday	Summer session examinations.
September 16, Saturday Noon	Latest date for candidates for Ph.D. degree in October to deposit theses.
September 30, Saturday Noon	Latest date to file application for the master's degree in October.
September 30, Saturday Noon	Latest date for candidates for the master's degree in October to deposit theses.
September 30, Saturday Noon	Latest date for finals for Ph.D. degree in October.

1950 First Semester

Sept. 15, Friday—Sept. 16, Saturday	Graduate registration.
September 16, Saturday	Latest date for registration of former students without payment of late registration fee.
September 21, Thursday	Instruction begins.
October 7, Saturday Noon	Latest date to apply for French examination.
October 12, Thursday	Latest date for changing program cards without fee.
October 14, Saturday Noon	Latest date to apply for German examination.
October 20, Friday	French examination.
October 27, Friday	German examination.
November 1, Wednesday	Latest date for preliminary examinations for Ph.D. degree (for full residence).
November 1, Wednesday	Latest date for candidates for professional engineering degrees to file statements of professional study and experience.
November 4, Saturday Noon	Latest date for adding a course to program.
November 22, Wednesday, 1 P.M.	Thanksgiving vacation begins.
November 27, Monday, 1 P.M.	Thanksgiving vacation ends.
December 3, Sunday	Illinois Day (State admitted to the Union, 1818).
December 9, Saturday Noon	Latest date for dropping a course.
December 20, Wednesday, 1 P.M.	Christmas vacation begins.
December 30, Saturday Noon	Latest date for candidates for professional engineering degrees to submit outlines of theses.

1951

January 3, Wednesday, 1 P.M.	Christmas vacation ends.
January 13, Saturday Noon	Latest date for candidates for Ph.D. degree in February to deposit theses.
January 20, Saturday Noon	No names will be added to the February graduation list after this date.

January 20, Saturday Noon.....Latest date for candidates for the master's degree in February to deposit theses.
Jan. 22, Monday—Jan. 30, Tuesday...Semester examinations.
January 27, Saturday.....Latest date for finals for Ph.D. degree in February.
February 3, Saturday Noon.....Latest date for candidates for Ph.D. degree in February to deposit abstracts.
February 11, Sunday.....Commencement exercises.

Second Semester

Feb. 8, Thursday—Feb. 9, Friday.....Graduate registration.
February 9, Friday.....Latest date for registration of former students without payment of late registration fee.
February 13, Tuesday.....Instruction begins.
February 15, Thursday.....Latest date for applications for fellowships 1951-1952.
February 24, Saturday Noon.....Latest date to apply for French examination.
March 2, Friday.....University Day (University opened, 1868).
March 3, Saturday Noon.....Latest date to apply for German examination.
March 7, Wednesday.....Latest date for changing program cards without fee.
March 9, Friday.....French examination.
March 16, Friday.....German examination.
March 22, Thursday, 1 P.M.....Easter vacation begins.
March 28, Wednesday.....Latest date for adding a course to program.
March 28, Wednesday.....Latest date for preliminary examinations for Ph.D. degree (for full residence).
March 28, Wednesday, 1 P.M.....Easter vacation ends.
April 14, Saturday Noon.....Latest date to apply for French examination.
April 19, Thursday.....Latest date for dropping a course.
April 21, Saturday Noon.....Latest date to apply for German examination.
April 27, Friday.....French examination.
May 1, Tuesday.....Latest date for candidates for professional engineering degrees to deposit theses.
May 4, Friday.....German examination.
May 4, Friday.....Honors Day.
May 19, Saturday Noon.....Latest date for candidates for Ph.D. degree in June to deposit theses.
May 29, Tuesday.....No names will be added to the June graduation list after this date.
May 29, Tuesday.....Latest date for candidates for the master's degree in June to deposit theses.
May 30, Wednesday.....Memorial Day. No classes.
June 1, Friday—June 9, Saturday.....Semester examinations.
June 2, Saturday.....Latest date for finals for Ph.D. degree in June.
June 9, Saturday Noon.....Latest date for candidates for Ph.D. degree in June to deposit abstracts.
June 17, Sunday.....Commencement exercises.

NOTES

Examination in one foreign language must be passed before residence on second year may be counted.
Two copies of thesis are required of candidates for master's and doctor's degrees.
Candidates for master's degrees announce thesis subjects at beginning of second half-year of work, or after completion of four units, or at beginning of third summer session.
Candidates for Ph.D. degree announce thesis subjects within six weeks after beginning of third year of residence.
Candidates for Ph.D. degree deposit theses two weeks before date of final examination.

EXECUTIVE OFFICERS OF FIELDS OF INSTRUCTION

*Aeronautical Engineering	Henry Sheldon Stillwell
Agricultural Economics	Harold Clayton M. Case
*Agricultural Engineering	Emil Wilhelm Lehmann
Agronomy	William Leonidas Burlison
Animal Science	Leslie Ellsworth Card
Animal Nutrition	Harold Hanson Mitchell
*Architecture	Turpin Chalmers Bannister
*Art	Allen Stuart Weller
*Astronomy	Robert Horace Baker
Bacteriology	Halvor Orin Halvorson
*Biological Sciences	Oswald Tippo
Botany	Oswald Tippo
Business Organization and Operation	Hiram Thompson Scovill
Accountancy	
Business	
*Commercial Teaching	
*Management	
*Marketing	
Ceramic Engineering	Andrew Irving Andrews
Chemistry	Roger Adams
Civil Engineering	Whitney Clark Huntington
Classics	John Lewis Heller
Dairy Science	Glenn Wade Salisbury
Economics	Everett Einar Hagen
Education	Willard B. Spalding
Electrical Engineering	John Douglass Ryder
English	Gordon Norton Ray
Entomology	William Patrick Hayes
Food Technology	Louis Bradley Howard
Dairy Technology	Paul Hubert Tracy
French	Joseph Francis Jackson
Geography	Joseph Albert Russell
Geology	George Willard White
German	Helmut Rehder
History	Frederick Charles Dietz
*Home Economics	Janice Minerva Smith
Horticulture	Charles John Birkeland
*Journalism	Fredrick Seaton Siebert
*Labor and Industrial Relations	W. Ellison Chalmers
*Landscape Architecture	Otto George Schaffer
Law	Albert James Harno
Library Science	Robert Bingham Downs
Mass Communications	Fredrick Seaton Siebert
Mathematics	Stewart Scott Cairns
Statistics	

* Give work for master's degrees only.

Mechanical Engineering	Norman Alwyn Parker
Mining and Metallurgical Engineering	Harold Leroy Walker
*Music	Duane Adams Branigan
Philosophy	Matthew Thomas McClure
Physical Education	Seward Charle Staley
*Physical Sciences	John Christian Bailar, Jr.
Physico-Chemical Biology	Robert Emerson
Physics	Francis Wheeler Loomis
Physiology	Robert Eugene Johnson
Plant Pathology	Wayne Melville Bever
Political Science	Charles Mayard Kneier
Psychology	Lyle Hicks Lanier
*Social Sciences	Raymond Phineas Stearns
*Social Welfare Administration	Marietta Stevenson
Sociology and Anthropology	John William Albig
Spanish and Italian	John Van Horne
Speech	Karl Richards Wallace
Theoretical and Applied Mechanics	Fred B. Seely
Veterinary Pathology and Hygiene	Robert Graham
Zoology	Frank Bolton Adamstone

* Give work for master's degrees only.

Part of the University Campus
with the Illini Union Building
in the Center Foreground

THE GRADUATE COLLEGE

Graduate instruction is offered on the Urbana campus in the fields of learning described in this catalog. Questions pertaining to the general rules and regulations which are described in the first section of this catalog should be directed to the Dean of the Graduate College. A prospective student who has a specific question concerning a particular course or program of study should write to the department or division concerned. A list of departmental heads and divisional chairmen is found on page 8. Questions concerning housing should be directed to the Director of Housing, 108 Illini Hall.

Graduate programs leading to advanced degrees in the medical and dental sciences and in pharmacy are available at the professional colleges in Chicago. Bulletins describing the courses, the conditions of admission, and the requirements for the degrees offered there can be obtained from Dr. Milan V. Novak, Associate Dean of the Graduate College, 1853 West Polk Street, Chicago 12, Illinois.

Character of Graduate Work. Didactic instruction, though ordinarily necessary to supplement undergraduate preparation, is by no means the most important part of a graduate program. The main purpose of graduate work is to enable a student to broaden his knowledge of a given field and to increase his competence. Graduate work, especially in the second and third year of the doctorate, aims at the development of independent scholarship, originality, and competence in research. Achievement of these aims is usually sought through instruction in small classes or seminars, according to methods, standards, and ideals which vary widely from one field to another.

Students from Abroad. Foreign students who desire to be admitted to graduate work at the University of Illinois should write to the Director of Admissions, 100a Administration Building, enclosing copies of all transcripts. Immigration requirements demand that a foreign student admitted to this country as a non-quota student must register each semester for not less than three units of work if he is enrolled in the Graduate College.

Arthur Hamilton, Assistant Dean for Foreign Students, 214 Lincoln Hall, will assist foreign students with problems involving passports and visas and other matters peculiar to them.

All students whose native tongue is not English are required to take an examination in English before registration. If their command of the language is not adequate, they are required to enroll in courses

for the study of English as a foreign language. Credit earned in these courses will not apply to an advanced degree.

Time Limit for Advanced Degrees. From the time of entrance upon graduate work at the University of Illinois, the work for a master's degree must be completed in not more than six calendar years, and that for a doctor's degree in not more than seven calendar years.

This regulation is applicable to those entering the Graduate College for the first time in September, 1950, or thereafter, and applicable also to those who, not yet having completed the requirements for an advanced degree, last engaged in graduate work at the University of Illinois during the second semester of the academic year 1939-1940, or earlier.

Admission

Applications for admission are processed by the Director of Admissions and Records. Application forms can be obtained from the Graduate College or from the office of the Director of Admissions. A qualified applicant can be admitted at any time, but, in order to avoid delays, prospective students are urged to submit their applications several weeks in advance of the opening of the session in which they plan to enroll. An official transcript from each undergraduate college attended must be sent to the Director of Admissions and Records. Transcripts of students who enter the Graduate College can not be returned.

The general requirements governing admission are as follows:

(1) *Admission with Full Status.* Admission to the Graduate College is granted to graduates of institutions whose requirements for the bachelor's degree are substantially equivalent to those of the University of Illinois, provided the applicant's undergraduate grade-point average for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training, is at least 3.50,[1] provided further that the undergraduate preparation is appropriate to advanced study in the chosen major field. Certain departments require of entering graduate students a minimum grade-point average higher than the general minimum of 3.50. Definite information concerning the average required will be found in the departmental sections.

(2) *Admission with Advanced Standing.* Admission to the Graduate College is granted to those who hold a bachelor's degree and have completed one or more years of graduate study at an accredited insti-

[1] An average of 3.5 is a grade average half-way between C and B in the grading system where A corresponds to 5.0.

tution and who desire to become candidates for the degree of Doctor of Philosophy at the University of Illinois, only upon the favorable recommendation of the department of the major field of study and of the Dean of the Graduate College. If admission is granted to such an applicant, the amount of credit to be allowed will be determined by the Dean upon the recommendation of the major department.

(3) *Admission with Limited Status.* In the departments requesting this arrangement, a person whose record in undergraduate work does not meet the requirements for admission with full status may be admitted on limited status. A student originally admitted on limited status may, upon completion of not less than the equivalent of three units of work, petition the Executive Faculty of the Graduate College to be transferred to full status. In September, 1950, the following departments will admit students on limited status: Agricultural Economics, Architecture and Architectural Engineering, Dairy Science, French, History, Home Economics, Landscape Architecture, Mathematics, Mining and Metallurgical Engineering, Music, Philosophy, Physico-Chemical Biology, Plant Pathology, Sociology and Anthropology, Speech, and Veterinary Pathology and Hygiene.

Graduate Study by College Seniors. College seniors who are within five semester hours of obtaining the baccalaureate degree may, provided they have been in residence for at least two semesters and have a grade-point average of approximately 4.0, apply for admission to the Graduate College in the usual way. Such a student, if admitted, must carry as miscellaneous course work the hours required to complete the requirements for his baccalaureate degree; in addition, he may carry graduate work to be credited toward an advanced degree.

An undergraduate who is within ten hours of the baccalaureate degree may, if he has an excellent scholastic record, register in graduate courses for graduate credit provided he obtains the approval of his adviser, of the instructor or instructors of the courses concerned, and of the Dean of the Graduate College. In all such cases, the student's program card must be signed by the Dean of the Graduate College at the time of registration. Graduate credit so earned will not count toward an advanced degree unless the student qualifies for admission with full status at the close of the session and enrolls as a graduate student during the following regular semester.

Advisers. Every graduate student must have an adviser. The adviser will assist in planning and carrying through a program of graduate work which will fit the needs and desires of the student. New graduate students should go to the departmental office of the major field of study to discuss the selection of an adviser.

Registration and Program of Studies

Registration. A graduate student must register during the registration period at the beginning of each semester (see calendar, page 6). The registration of a new student will be accepted at any time, provided he is prepared to enter courses already under way for credit reduced in proportion to the length of time which has elapsed since instruction began. A former student who registers late (see calendar, page 6) must in addition pay a late registration fee of $5.

Graduate students obtain a program card and other registration material from the Graduate College office, 105 Administration (East), during scheduled registration days or at any time thereafter. The student should then consult his departmental adviser (see page 13). The adviser will suggest the course of study and, in the case of a new student, will determine what deficiencies, if any, must be made up; these will be listed on a prerequisite blank. If there are no deficiencies, the adviser will so indicate on this form. When the program card has been approved by the adviser, the student will secure on it the signatures of the individual instructors in whose courses he is enrolled. The program of a student who has a staff appointment or who holds a University Fellowship must be approved by the Dean of the Graduate College before his registration is completed. This signature can be obtained on the first day of registration or at any time thereafter, but not before. Program cards of other students do not require the Dean's signature.

Changes in Program Cards. A graduate student is expected to plan his work carefully with his adviser; changes in his program during the semester should not be necessary. However, if, in the judgment of a student and his adviser, a change is required, the student should obtain a change-of-study form at the Graduate College office, 105 Administration (East). This form must be signed by the adviser, the instructors involved, and the Dean of the Graduate College. After the dates indicated in the calendar (page 6) a fee of $1 is charged for each change. Except in cases of illness certified by an attending physician, *a student will not be permitted to drop a course during the last six weeks of a regular session.* The final date for dropping a course is shown in the calendar.

Unit Credit for Courses. Courses offering graduate credit are numbered from 300 to 399 when they are open to advanced undergraduates and to graduate students, and are numbered 400 and above when they are open to graduate students only. Courses numbered below 300 do not carry graduate credit.

Graduate credit is measured in terms of units. One unit is considered the equivalent of four semester hours. The normal program for a full-time graduate student is four units each semester; the maximum permissible is five. The credit which may be earned in individual courses is indicated in the course listing, and is in some instances variable. The credit for which the student is actually registered in every specific course is entered on the student's program card by his adviser and is subject to the approval of the Dean of the Graduate College.

Miscellaneous Courses. A graduate student carrying a normal graduate program may elect one miscellaneous subject (a course which does not give credit toward an advanced degree). If it is necessary for a graduate student to carry at the same time more than one miscellaneous subject, he may not register for a full graduate program. Courses intended to teach graduate students a reading knowledge of French or German are regarded as miscellaneous courses. A student who elects a miscellaneous course is required to register in it and do the assigned work, unless he is permitted to withdraw under the rules.

Auditing Privileges. A graduate student is permitted to attend classes as an auditor, provided a card bearing the approval of his adviser and of the instructor is filed at the Graduate College office. A student should not enter on his program card courses which he will attend as an auditor.

Graduate Programs for Employed Students. A student who is employed can not expect to complete his academic work as promptly as he otherwise could. The academic work carried by assistants and others on the University staff is limited by statute. Those employed outside the University are expected to reduce their program of work in accordance with these regulations. The maximum amount of academic work is determined by the terms of employment as follows:

	Maximum Registration	
Nature of Appointment	*Semester*	*Summer Session*
Full time	1 unit	1 unit
Three-fourths time	2 units	1 unit
Two-thirds time	2¼ units	1 unit
Half time	3 units	2 units
One-third time	3½ units	2 units
One-fourth time	4 units	2 units

Extramural Course Work. Graduate courses in a few areas of study are offered at various centers throughout the state. No student

may register for more than one unit of extramural course work in any one semester and no student who is employed full time may register for more than one unit each semester by any combination of extramural and campus courses.

A maximum of four units of graduate credit earned through extramural courses can be applied to the requirements for certain degrees in Education, Library Science, Physical Education, and Political Science. The head of a student's major department will be able to advise what extramural work, if any, can be applied to the requirements for the degree sought. With the specific approval of the head of the department concerned and of the Dean of the Graduate College, a limited amount of credit earned through extramural course work may be applied to advanced degrees in areas other than those listed above. Bulletins listing extramural course offerings can be obtained from the Dean of University Extension, 118a Illini Hall. No credit toward an advanced degree is allowed for *correspondence courses.*

Grades. Grades are recorded by the following letters: A, B, C, D, E. Any student who receives two units of grade below B must complete two additional units of A or B grade to qualify for an advanced degree. Three units of a grade below B disqualify a student as a candidate. A grade of E in any course in the major field precludes the conferring of a degree in the academic year in which the failure was incurred.

Withdrawal. When a student desires to withdraw from the University, he should obtain a withdrawal slip from the Graduate College office, 105 Administration (East). This slip must be signed by the representatives of the Director of the Library, the Bursar, and other officials as indicated, including the Dean of the Graduate College. If a student leaves the University without carrying through the steps necessary for withdrawal, he will receive failing grades in all course work.

When a student drops all the course work in which he is currently enrolled, he is considered to be withdrawing from the University. A student who is enrolled for one course only and who decides to drop this course is regarded as withdrawing from the University.

A student who has withdrawn from the University must apply for re-admission in order to obtain authorization to register again.

Graduate Study in the Summer. During the summer session, a student may take courses for credit toward higher degrees, subject to the residence requirements indicated below (page 17). The normal program for a summer term is two units; two and one-half units may be

carried with the approval of the adviser. In no case will a student be permitted to carry more than two and one-half units.

Petitions. The normal procedures and requirements of the Graduate College are indicated in this catalog, but these may be modified occasionally for justifiable reasons. A student may petition the Dean and the Executive Faculty of the Graduate College for exceptions, but he should do so only after consultation with his adviser. Forms can be secured at the Graduate College office, 105 Administration (East).

The Master's Degree

Requirements. A candidate for the master's degree must satisfy residence requirements, must complete at least eight units with satisfactory grades, and must submit a thesis unless his major department excuses him from this requirement. Before the degree will be granted, departmental requirements must be satisfied in addition to those stipulated by the Graduate College. Departmental requirements are stated in departmental announcements appearing in this catalog.

Residence Requirements. A candidate for the master's degree is required to be in residence for the equivalent of at least two semesters during each of which he is registered for at least two units of work. Students in actual residence who are carrying lighter programs of work must spend a proportionately longer time in satisfying this residence requirement; thus, for example, a full-time assistant registered for one unit per semester would discharge the residence requirement in four semesters of work.

Attendance in residence during four summer sessions in each of which the student is registered for not less than one unit of work, or one semester with not less than two units and two summer sessions with not less than one unit each, is regarded as the equivalent of two semesters in residence.

Registration for more than two units in a regular semester, or for more than one unit in a summer session, will not shorten the time which must be spent to discharge the residence requirement.

Work Done Elsewhere. A graduate student who has done graduate work in other approved institutions may obtain credit not to exceed four units toward the master's degree by passing examinations in that work. Admission to such examinations requires the prior approval of the Dean of the Graduate College. Such a student may complete the work for the master's degree by completing additional units while registered in the Graduate College for at least two semesters.

If it is recommended in advance by the adviser, the Graduate College may permit a student to register for work at a laboratory elsewhere offering facilities not available at Urbana, or in approved field work, with the understanding that such work will be accepted for graduate credit if completed satisfactorily. The adviser will examine the student's transcript or will examine the student directly when he returns to this campus and will then make a final recommendation to the Dean of the Graduate College concerning the credit to be given.

Majors and Minors. A candidate for a master's degree may do all his work in one field, or he may select a major and one minor, or a major and two minors, as indicated in specific cases in the latter part of this catalog. A major or minor denotes the field of knowledge of a department, or such part thereof as constitutes a separate and independent division of that field. For a master's degree a major comprises work totaling a minimum of four units. Less than one unit of work will not satisfy the requirements for a minor.

Foreign Language. The ability to use one or more of the modern languages ordinarily studied in the undergraduate curriculum is desired for all candidates for the master's degree and is required in some lines of study. A student who wishes to go beyond the master's degree to the doctorate should take at least one of the Graduate College language examinations during the first year of graduate study; no credit will be given toward the second year of the student's work for the doctorate until he has passed at least one language examination or its equivalent.

Master's Thesis. The subject of a thesis for the master's degree must be filed at the Graduate College office *by the student during the registration period prior to his graduation.* A student usually devotes two units of work to his thesis, and no more than three units of thesis credit may be earned except by special permission. For specific instructions with reference to the preparation and form of the thesis, the student should obtain at the Graduate College office a copy of the leaflet "Instructions for Preparation of Theses." Two copies of the thesis with a Certificate of Approval must be presented to the Graduate College office, 105 Administration (East), by the date specified in the calendar of the Graduate College. The Certificate of Approval for the master's thesis must be signed by the person under whose immediate supervision the thesis was prepared and also by the head of the major department. Blank certificate forms can be obtained at the Graduate College office.

The requirement of a thesis may be waived, on the recommendation

of the adviser and with the approval of the Dean, *provided application to waive the thesis is made at the time for announcing thesis subjects.* A student excused from writing a thesis must replace it with courses of instruction.

Thesis Work on Leave of Absence. A student who has completed six units of course work in residence and wishes to complete his thesis in absentia should submit a petition to the Executive Faculty. The petition must include an outline of the proposed investigation, evidence that adequate facilities for pursuing it will be available, and a statement of approval by the student's adviser.

Teacher-Education Programs. Programs leading to the master's degree for teachers in various fields are offered to students who have satisfactorily completed the four-year undergraduate teacher-training program. Students who have not met all of the requirements of a four-year undergraduate curriculum but desire to take the fifth year of work for a master's degree may register in an approved program with the permission of the adviser and the Coordinator of Teacher Education. Programs for teachers are offered in the following areas, the special requirements for each being given in this catalog at the page indicated:

Agriculture — page 40
Art — page 49
Biological Sciences and General Sciences — page 53
Chemistry — page 71
Commercial Teaching — page 64
Education of the Deaf and Hard of Hearing — page 103
Education of Mentally Handicapped Children — page 103
English — page 126
French — page 138
Geography — page 141
German — page 149
Home Economics — page 159
Latin — page 87
Mathematics — page 182
Mathematics and the Physical Sciences — page 183
Music — page 199
Physical Education — page 209
Physical Sciences — page 211
Physics — page 215
Social Studies — page 235
Spanish — page 244
Speech — page 248
Speech Correction — page 248

Conferring of Degrees. The master's degree is conferred in February, June, August, and October. Each student is responsible for entering on his registration cards, during the registration period preceding the Commencement at which he expects to be awarded his degree, the fact that he is a candidate for a degree to be awarded at the forthcoming Commencement. If the candidate is not currently registered in the Graduate College, he must present his application to receive a degree at the Graduate College office, 105 Administration (East), no later than the final date specified in the calendar.

Not later than one week before Commencement, each candidate for an advanced degree must obtain a clearance paper from the Graduate College, 105 Administration (East). The student must obtain all the signatures called for on the form and return it to the Graduate College.

The Degree of Doctor of Philosophy

The degree of Doctor of Philosophy is offered in the fields indicated on page 8. The general requirements for the degree are described below. Special departmental requirements will be found under the departmental listings.

Residence Requirements. For the degree of Doctor of Philosophy, the student must spend in resident study at an accredited educational institution all three of the "years" required to obtain the degree; such "years" are defined as follows:

First "Year." The time required to complete eight units of graduate work with satisfactory grades in course, and to pass one foreign language examination.

Second "Year." The time required to progress from the completion of the first year's work through the completion of the preliminary examination. This involves obtaining satisfactory grades in eight more units of graduate work, passing the second foreign language examination, and passing the preliminary examination.

Third "Year." The time spent between successful completion of the preliminary examination and the completion of all requirements for the doctor's degree.

A student who spends the first two years in residence at the University of Illinois may, by petition, request permission to spend the last year in absentia. A student who has completed the first year of graduate work elsewhere must be in residence during the two remaining years. In exceptional cases, a student with two years of graduate study elsewhere who satisfies his major department that he has completed work equivalent to the standard departmental requirements will be permitted to take his preliminary examination, provided he has fulfilled the language requirements. If such a student passes the preliminary examination, he may complete the requirements for the Doctor of Philosophy degree by devoting the third year to research in residence.

A student may satisfy the residence requirement in part by attending summer sessions at the University of Illinois, attendance during four summer sessions being considered the equivalent of one year's residence. However, at some time during the second or third years of

his doctoral program, the student must be in residence at the University through two successive semesters.

Major and Minor Subjects. A candidate for the degree of Doctor of Philosophy is required to pursue a major subject in the area of his research interest. He is also required to choose one or two minor subjects. If only one minor is chosen, it is called a "sole minor," and must be taken in an area other than that of the major. Credit for it must be earned by work representing not less than four units. If two minors are chosen, the first may be a subject closely related to the major. With the approval of the adviser, it may be a division of the major field of study; it must involve at least two units. In such a case, the second minor (not less than two units) must be taken in an area other than that of the major.

Language Examinations. The student will be required to demonstrate his ability to read French and German and no student will be considered as beginning his second year of graduate study until he has passed the examination in at least one of these languages. Both language examinations must be passed before the student is admitted to the preliminary examination. The dates of the language examinations and the dates when application for admission to these examinations must be made are shown in the calendar at the beginning of this catalog.

Preliminary Examinations. A candidate for the doctor's degree must pass a preliminary examination intended to test his knowledge of his major and minor fields of study. He will not be admitted to this examination before (1) he has passed the two required language examinations or their equivalent, (2) he has satisfactorily completed at least *sixteen units* of graduate work, and (3) his adviser and the head of the department of his minor field of study consider that he has adequate preparation in his major and minor fields. Upon the recommendation of the adviser, the Dean of the Graduate College will appoint the examining committee for the preliminary examination. This examination will be partly or entirely oral. Consult the calendar of the Graduate College (page 6) for the latest dates for preliminary examinations.

Theses. The Doctor of Philosophy is primarily a research degree; consequently, the candidate is required to demonstrate his capacity for independent research by the production of an original thesis on some topic connected with his major field of study. The subject of the thesis should be chosen by the end of the second year and must be reported to the Graduate College office no later than six weeks after the beginning of the third year. The student should be registered

in his thesis course for the number of units corresponding to the amount of time devoted to thesis research, four units being the equivalent of full-time work.

Not later than two weeks before the time set for his final examination, and not later than four weeks before the time when he hopes to receive the degree, the candidate must submit to the Graduate College, for approval of the format, two typewritten copies of his thesis in final form, *the original on special thesis paper,* and the first carbon on plain paper, no lighter than sixteen pounds. The style and form of the thesis must comply with the regulations given in the leaflet "Instructions for Preparation of Theses," copies of which can be obtained in the Graduate College office. After the thesis has been checked at the Graduate College office, the student must arrange that each member of the final examining committee has an opportunity to read the thesis before the date of the final examination. At the conclusion of the candidate's final examination, the thesis must be deposited at the Graduate College office.

The candidate who sustains the final examination must satisfy thesis publication requirements by one of the methods described below:

(1) No later than one week before Commencement, the candidate must deposit with the Graduate College one hundred printed copies of the essential part, or an abstract, or digest of his thesis, indicating the method followed, the evidence used, and the conclusions reached in the investigation. A Certificate of Approval signed by the major adviser must accompany these abstracts or be on file at the Graduate College.

(2) If the candidate expects to have his thesis accepted for publication in its entirety or in an abbreviated form by a standard journal or publisher within a year from the date of his graduation, he may pay the Bursar $75 and at the same time deposit with the Graduate College an abstract of his thesis (and the Certificate of Approval) in a condition for publication at a cost not to exceed $75.

If the thesis is accepted for publication within the year, one hundred reprints may be deposited at the Graduate College when they are available. Unless the student has made other arrangements to do this, the Graduate College will have the reprints bound with the required covers, title page, and vita, these charges being deducted from the $75 deposit. The balance of the deposit will be refunded.

If the thesis is not accepted for publication within the year, the University will print one hundred copies of the abstract for distribution and the deposit will not be returned.

(3) The candidate may choose to have his thesis microfilmed by an approved microfilming service.

The candidate who elects this service must advise the Graduate College of his intention when he deposits his thesis or when he obtains his clearance paper from 105 Administration (East). He will pay the Bursar $35 and will deposit with the Graduate College office the original and first carbon of his thesis and two copies of an abstract of *six hundred words or less.*

The Graduate College will make arrangements with the microfilming service to: (1) microfilm the thesis and obtain one positive print for the University Library; (2) print the abstract in the next issue of an abstract journal to be distributed to leading libraries here and abroad; (3) catalog the manuscript and print and distribute library cards in accordance with the Library of Congress procedures; (4) obtain copyright protection in the name of the author.

The $35 fee is a payment for these services; it is not a deposit, and no refunds will be made to the student.

Final Examinations. When the thesis has been completed, if the major adviser so recommends, the candidate will be given his final examination by a committee appointed by the Dean of the Graduate College. A student who, in the third year of study, fails to meet the expectations of the professors in charge of his work, or in any way fails to maintain the standard of scholarship and power of research expected of him, may be refused admission to the final examination.

The final examination must be completed at least two weeks before Commencement. Consult the calendar of the Graduate College (page 6) for the latest date for the final examination. This examination is concerned primarily with the research work of the student as embodied in his thesis, but it may be much broader and extend over the whole field of study of the candidate. The intention of the final examination is to verify that the candidate has a satisfactory grasp of his major subject as a whole, and a general acquaintance with the fields of knowledge represented by his course of study.

The final examination is oral and will be conducted entirely in the presence of the examining committee appointed by the Dean.

Conferring of Degrees. The doctor's degree is conferred in February, June, and October. Not later than one week before Commencement, each candidate for an advanced degree must obtain a clearance paper from the Graduate College office, 105 Administration (East). The student must obtain all the signatures called for on the form, and then return it to the Graduate College.

Professional Degrees

The degrees of Master of Arts, Master of Science, and Doctor of Philosophy are offered in a variety of subjects, but the basic requirements are the same regardless of the subject. In addition, the University of Illinois offers special programs of graduate study leading to professional degrees.

Education. Two professional degrees in Education are offered: Master of Education (Ed.M.) and Doctor of Education (Ed.D.). For the requirements for these degrees see Education, page 102.

Engineering. Two classes of degrees are open to graduates of the College of Engineering, namely, academic and professional.

The academic second degree in engineering is Master of Science, following Bachelor of Science, in civil engineering, electrical engineering, etc. This degree is conferred in accordance with the regulations described above for academic work in residence only.

The degree of Doctor of Philosophy in Engineering is offered in the following departments: Ceramic Engineering, Chemical Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering, Mining and Metallurgical Engineering, Physics, and Theoretical and Applied Mechanics. The general requirements for this degree as to preliminary education, residence, etc., are the same as in other fields of study.

The professional second degrees in engineering are as follows:

Agricultural Engineer, after B.S. in agricultural engineering.

Master of Architecture, after B.S. in architecture.

Architectural Engineer, after B.S. in architectural engineering.

Ceramic Engineer, after B.S. in ceramic engineering.

Chemical Engineer, after B.S. in chemical engineering.

Civil Engineer, after B.S. in civil engineering or in railway civil engineering.

Electrical Engineer, after B.S. in electrical engineering or in railway electrical engineering.

Engineer-Physicist, after B.S. in engineering physics.

Mechanical Engineer, after B.S. in mechanical engineering or in railway mechanical engineering.

Metallurgical Engineer, after B.S. in metallurgical engineering.

Engineer of Mines, after B.S. in mining engineering.

Professional degrees in engineering may be conferred on two classes of candidates: (1) those who have received an academic degree in engineering or in architecture from the University of Illinois; (2) those who have received an academic degree in engineering, in-

cluding chemical engineering, from other institutions of equal standing and who have been members of the teaching or research staff of the College of Engineering or Engineering Experiment Station or the Departments of Chemistry or Architecture of the University of Illinois for at least three years prior to the conferring of the professional degree.

A candidate declares his candidacy by filing with the Dean of the College of Engineering, as chairman of the committee in charge, a detailed statement covering his professional engineering experience. This statement must be made on a standard form supplied by the Dean of the College of Engineering, and must be filed not later than the first Monday in November preceding the Commencement at which the candidate expects to receive the degree. No statement of experience will be considered by the committee which does not show that the candidate has had a minimum of eight years of acceptable engineering experience after receiving the degree of Bachelor of Science, and that for at least five years he has been in responsible charge of engineering work. Responsible charge in engineering teaching may be considered as responsible charge of work. In determining the acceptability of the engineering experience of the candidate, the committee will be guided by the character of his professional work and the degree of responsibility involved, and will take into consideration such evidences of professional ability and growth as may be shown by his investigation of engineering problems, and contributions to technical literature, and his membership and activity in engineering societies.

If the professional experience of the candidate is accepted, he must submit for approval, before December 31, an outline of his proposed thesis. The completed thesis, in the form prescribed in the "Instructions for Preparation of Theses," must be submitted to the Dean of the College of Engineering for approval not later than May 1. Major technical reports or plans and specifications for major engineering projects conceived and designed or directed by the candidate may be submitted for approval in lieu of a thesis. The candidate must attend Commencement in order to receive the degree.

A candidate for a professional engineering degree must pay the tuition fee of $25 on being notified that his professional experience is accepted as qualifying him to enter as a candidate for the degree. No one will be enrolled as a candidate for the degree at the following Commencement who does not pay his fee at this time. When a candidate for a professional engineering degree has once been accepted and paid his fee, he is eligible to receive the degree at any time within five years, without additional fee, on completion of the requirements;

provided, however, that unless he completes the requirements within two years his name will be dropped from the list of candidates and in order to receive the degree within the five-year period he must register once more.

Library Science. Two graduate degrees are offered in Library Science, the Master of Science and the Doctor of Library Science. For the requirements for these degrees see the instructions under Library Science, page 176.

Social Welfare Administration. For the requirements for the degree of Master of Social Work, see Social Welfare Administration, page 236.

Libraries

The University Library's resources for advanced study and research are outstanding. Its present collections now exceed 2,280,000 volumes, all except about 110,000 volumes being located in Urbana. The remainder are held by the Library of Medical Sciences in Chicago and the Undergraduate Division in Chicago.

In addition to the figures for cataloged volumes cited above, the University Library contains approximately 500,000 pamphlets, 75,000 maps, and 24,000 music scores and parts. More than 18,000 periodicals and newspapers are currently received.

Outstanding collections have been developed for a variety of fields. In the humanities, strong areas include classical literature, history, and archeology; sixteenth and seventeenth century English literature, especially the Milton-Shakespeare period; French, Italian, and Spanish literature; German literature of the sixteenth and seventeenth centuries; and comparative philology. In the fine arts, collections in architecture, landscape architecture, and music are noteworthy.

In the social sciences, the Library's holdings are significant for western United States history, Latin American history of the Revolutionary period, Italian history, medieval and modern European history, German history for 1830-1900, Irish history, international law and relations, political science, law, economics, labor and industrial relations, and education.

For science and technology, collections of high rank are held in mathematics, chemistry, biological sciences (especially parasitology, entomology, and ornithology), physics, geology, engineering, and agriculture.

The Library's bibliographical facilities comprise a union catalog of more than 3,000,000 cards, representing titles owned by about two dozen major American and foreign libraries; printed catalogs of

libraries, e.g., the Bibliothèque Nationale, British Museum, and Library of Congress; national and trade bibliographies of all countries for which such works have been issued; bibliographies of special subjects; and similar aids.

A number of departmental and divisional libraries are maintained. Following are the principal separately administered collections in the central library building: Classics; Commerce, Sociology, and Social Welfare Administration; Education, Philosophy, and Psychology; English; Germanic and Romance Languages; History and Political Science; Library Science; and Physical Education.

Elsewhere on the campus are departmental libraries for the following fields: Agriculture, Architecture and Fine Arts, Chemistry, Engineering, Journalism, Landscape Architecture, Law, Mathematics, Music, Natural History (biological sciences, geology and geography), Natural History Survey (entomology and other biological sciences), and Physics.

Further facilities available for graduate students are free access to the general bookstacks, housing about 1,500,000 volumes, and 216 carrells in the bookstacks, assigned to individuals engaged in prolonged study and research. Interlibrary loan service from other institutions is provided for those engaged in research for dissertations.

Fellowships

In addition to the fellowships listed below, there are others for students in specific fields of instruction. These are listed under the departmental headings.

University Fellowships. University Fellowships are awarded each year to promising graduate students for work in any field in which the University offers a master's or doctor's degree. Fellowships carry exemption from tuition and all fees of the regular academic year, except the Hospital and Medical Service Fee of $5 a semester, during the period of the fellowship. The stipends are as follows:

First-year fellowship	$ 700
Second-year fellowship	850
Third-year fellowship	1,000

The holder of a University Fellowship is granted free tuition for the summer session following the termination of the academic year in which his fellowship was effective, if he desires to continue his studies during the summer. Alternatively, if the recipient has been in residence as a graduate student at the University of Illinois for one

academic year, he is granted free tuition for the summer session immediately preceding the effective date of his fellowship.

Candidates for fellowships must be graduates of the University of Illinois, or of colleges or universities having equivalent requirements for the bachelor's degree. To be eligible for a third-year fellowship an applicant must pass the preliminary examination no later than one month following the beginning of the session during which the fellowship is effective.

Application must be made on blanks obtained from the Dean of the Graduate College and should be submitted before February 15 of the academic year preceding that for which the fellowship is desired. An application received later than February 15 will not be considered until after April 15.

A person appointed is notified on April 1, and must send the Secretary of the Board of Trustees notice of his acceptance or refusal by April 15. If he accepts, he must agree that the appointment will not be resigned to take a similar one at any other institution during the year for which it is awarded, that he will not engage in any outside employment for remuneration, and that, without the consent of the University, he will neither attempt to hold concurrently any other fellowship carrying a stipend, nor abandon the appointment during the year.

A limited number of University Fellowships are awarded for the second semester. Applications for such fellowships must be received no later than December 1.

Nonresident Fellowships. A limited number of nonresident special fellowships may be awarded to exceptional graduate students for the purpose of enabling them to make direct observations or to do archival work away from the University in accordance with a plan approved by the major departments concerned. An applicant for such a fellowship will be required to appear in person before the Graduate College Fellowship Committee to explain his proposed plan for the use of the fellowship. Applicants should apply for these fellowships by February 15, although it may be possible to consider applications at other times during the year. The stipend for such fellowships will vary in accordance with the particular project, with a maximum stipend of $3,000 a year.

Resident Post-Doctoral Fellowships. A limited number of post-doctoral fellowships carrying a maximum stipend of $3,000 a year are provided. These fellowships are intended to provide opportunities for further training and development for outstanding students of great

originality who wish to make additional use of the research facilities of the University after receiving the doctor's degree. The recipient must enter upon the fellowship within one year of the time when he received the doctorate. An applicant must submit a detailed program of research or study which he has conceived and formulated himself, and he will be interviewed by the Graduate College Fellowship Committee. Applicants should apply for this fellowship by February 15, although it may be possible to consider applications at other times during the year.

Industrial Fellowships. Fellowships for graduate students in Chemistry, Geology, Electrical Engineering, and other departments are provided by gifts to the University made by various industrial or scientific corporations. Such fellowships are not listed here; information concerning them may be obtained from the student's major adviser. Industrial fellowships are ordinarily not offered to new students.

Wright Fellowships. Through the generous bequest of Harry G. Wright and Harriette A. Wright, a number of Wright Fellowships are awarded annually to exceptional students expressing a desire to work in agriculture or in fields closely related thereto, preference being given to residents of Illinois if their qualifications in other respects are equal to residents of other states. The Wright Fellowships carry the same stipends as the University Fellowships, and the same procedures apply.

Booth Fellowships. The Charles H. Booth Fellowships are awarded to exceptional students in agriculture. In general, the stipend is the same as for University Fellowships, and the same procedures apply.

Strong Fellowship. The Henry Strong Fellowship is awarded annually to an exceptional student in physics, chemistry, or engineering subjects who is not over twenty-five years of age. This fellowship carries the same stipend as a University Fellowship, the principal portion of the stipend being provided by the Henry Strong Educational Foundation. The same procedures apply as for the University Fellowships.

Assistantships

A number of teaching or research assistantships are available for graduate students. Application should be made to the head of the department in which the assistantship is desired. Students wishing to obtain assistantships beginning in September should apply to the department head concerned before the preceding January 15. The normal

salary is $2,400 a year for a full-time assistant; most assistantships are on a part-time basis, the largest number being half-time appointments at $1,200 a year. Assistants must carry a reduced study schedule as shown on page 15, but the greater length of time required for an assistant to secure the degree is somewhat compensated by an additional gain in teaching or research experience.

Fees and Expenses

Persons on the academic or administrative staffs of the University or allied surveys in any capacity, or who are on permanent employment on the nonacademic staff (subject to the approval of the head of their department or division), whose salaries do not exceed $2,400 for nine months appointment or $2,934 for twelve months appointment, are exempt from payment of all registration fees. Those with salaries above these maximums pay tuition and the laboratory, library, and supply fee. Holders of fellowships or graduate scholarships are exempt from all fees except the hospital and medical service fee. Holders of general scholarships are exempt from tuition only. All other students registering for resident work pay fees each semester or summer session as follows:

Semester Fees

	Regular Schedule (*Over two units*)	*Reduced Schedule* (*Two units or less*)
Tuition Fee		
Residents of Illinois	$40.00	$12.00 per unit
Nonresidents of Illinois	80.00	24.00 per unit
Laboratory, Library, and Supply Fee	8.00	4.00
Hospital and Medical Service Fee	5.00	5.00
Students who present evidence of participation in any other insurance system providing the same benefits as those covered by the University fee may petition the Dean of Students for refund of this fee. Students registered for not over one unit are exempt from this fee.		
Illini Union Service Charge	5.00	5.00
Students registered for not over one unit are exempt from this fee.		
General Deposit (if not previously paid)	5.00	5.00
This fee is payable by each student at the time of his first registration, and any unused balance remaining to his credit at his graduation or official withdrawal will be refunded to him. Chargeable against this deposit are such items as lost books, library fines, unreturned towels		

	Regular Schedule (Over two units)	*Reduced Schedule (Two units or less)*
and locks, shortages in laboratory equipment, and other supplies loaned to students. Whenever the balance in a student's deposit account falls below $2.50, he is required immediately by additional deposit to bring the total up to $5.00.		
Late Registration Fee	5.00	5.00
Former students, whether on appointment or not, who register after the regular registration days in either semester are subject to this fee.		

Summer Session Fees

	Regular Schedule (Over one unit)	*Reduced Schedule (One unit or less)*
Tuition Fee		
Residents of Illinois	$20.00	$12.00 per unit
Nonresidents of Illinois	40.00	24.00 per unit
Laboratory, Library, and Supply Fee	4.00	2.00
Hospital and Medical Service Fee	2.50	2.50
A student registered for not over one-half unit is exempt from this fee.		
Illini Union Service Charge	2.50	2.50
A student registered for not over one-half unit is exempt from this fee.		
General Deposit (if not previously paid)	5.00	5.00

Semester and Summer Session Fees

Change of Program Fee	1.00
This fee is charged for every change slip issued later than the date shown on the Graduate College calendar.	
"In Absentia"	20.00
Students enrolled for thesis work for the master's or doctor's degree on leave of absence pay the tuition fee only.	
Professional Degrees	25.00
This fee is payable by candidates for professional degrees in Engineering each year.	
Transcript Fee	0.50
Each student who has paid all his University fees is entitled to receive, without charge, one transcript of his record. For each additional transcript the fee is $.50.	

Service Charge for Deferred Fees. A service charge of ten per cent of the amount of fees deferred, but not to exceed $3.00 a semester, is assessed for the privilege of deferring fees. If deferred fees are paid in full within ten days after registration, the service charge is refunded except that a minimum service

charge of $1.00 is retained by the University in all cases. The general deposit (if this deposit has not been made earlier), the hospital and medical service fee, the Illini Union service charge, the service charge for deferring fees, and all charges from previous semesters must be paid on the day of registration.

Expenses. Although personal expenses may vary a great deal, the following estimates indicate the average cost for students: board, $12 to $15 a week; room rent, single rooms from $18 to $30 a month; double rooms from $15 to $20 a month for each person.

FIELDS OF INSTRUCTION

Courses open to graduate students are of two classes. Those numbered from 300 to 399 are open to advanced undergraduate and graduate students. Those numbered 400 and above are open to graduate students only.

Many courses for graduate students require some measure of previous preparation. By consultation with the adviser, a student may learn whether he has had the necessary prerequisites for a particular course.

The fellowships listed below under the various fields of instruction are specifically allocated to those fields. In addition, there are other fellowships not specifically assigned (see page 27).

AERONAUTICAL ENGINEERING

The Department of Aeronautical Engineering offers graduate work leading to the degree of Master of Science in Aeronautical Engineering. The principal fields of study are aerodynamics, aircraft propulsion, and aircraft structures.

Students having the prerequisites described below may apply for admission to graduate study in aeronautical engineering if they have a grade-point average of at least 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. No student will be admitted on limited status. The progress of any student admitted with an average of less than 4.0, computed on the same basis as above, will undergo special review by a departmental committee after completion of the student's first semester of residence to evaluate his qualifications for further graduate study. No student will be excused from the thesis requirement.

The prerequisite for graduate study in aeronautical engineering is the equivalent of the undergraduate courses required at the University of Illinois for a bachelor's degree in aeronautical engineering in the branches of the subject in which graduate registration is desired. Graduate study in certain divisions of aeronautical engineering requires, as a prerequisite, the equivalent of selected courses available as electives to advanced undergraduate and graduate students at the University of Illinois. Where it is necessary, these courses must be taken before registering in the advanced courses.

Graduate students who desire to minor in aeronautical engineering must have taken mathematics through the first course in differential equations and undergraduate aeronautical engineering courses, equivalent to those offered at the University of Illinois, which are prerequisites to study in the branch of the subject in which the minor work is to be pursued. Where special cases warrant deviation from these requirements, approval from the Head of the Department is required.

Assistantships

A limited number of part-time special graduate research assistantships are available to well-qualified students pursuing graduate study in aeronautical engineering. Application forms for these assistantships may be had upon request to the Department of Aeronautical Engineering.

Graduate Teaching Faculty

Professors: H. S. Stillwell (Head of Department), M. Z. Krzywoblocki, R. W. McCloy.

Associate Professors: J. M. Coan, P. Torda.

Research Assistant Professor: C. H. Fletcher.

Instructor: A. I. Ormsbee.

Courses for Graduates

411. Advanced Aerodynamics of Compressible Fluids. Advanced aerodynamics theory of compressible fluids in the subsonic and supersonic velocity ranges. I; 1 unit. Krzywoblocki.

412. Theory of Turbulence. Introduction to the classical and modern theories of turbulence: Reynold's, Prandtl's, Karman's, Karman's-Howarth's, Kolmogoroff's, Heisenberg's, Krzywoblocki's theories in compressible fluids; Kampe d'Feriet's theory. II; 1 unit. Prerequisite: Consent of instructor. Krzywoblocki.

421. Analysis of Aircraft Shell Structures. Advanced treatment of reinforced plate, box, and shell structures; effect of cutouts, taper, and sweepback on the analysis of wing structures; restrained warping; shear lag and diffusion of load. I; 1 unit. Prerequisite: Aeronautical Engineering 320, or consent of instructor. Coan.

431. Aerothermodynamics. The fundamental principles of classical and statistical thermodynamics, as well as of fluid flow are treated. The laws of thermodynamics and aerodynamics are applied to problems, such as heat transfer by convection, heat transfer by conduction in laminar and turbulent flows, heat transfer in the boundary layer with fluid injection and suction, steady and non-steady flows with heat addition; some special topics. Theories of flame propagation are discussed. Chemical kinetics of gaseous reactions and combustion of hydrocarbons are covered. I; 1 unit. Prerequisite: Consent of instructor. Torda.

491. Thesis. Thesis in one of the fields of aeronautical engineering. I; 1 to 2 units. Coan, Fletcher, Krzywoblocki, McCloy, Torda, Stillwell.

492. Thesis. Thesis in one of the fields of aeronautical engineering. II; 1 to 2 units. Coan, Fletcher, Krzywoblocki, McCloy, Torda, Stillwell.

493. Special Problems. Theoretical and experimental investigations in the following fields: aerodynamics, aircraft propulsion, aircraft structures, and aircraft components. I; 1 to 2 units. Coan, Fletcher, Krzywoblocki, McCloy, Torda, Stillwell.

494. Special Problems. Theoretical and experimental investigations in the following fields: aerodynamics, aircraft propulsion, aircraft structures, and aircraft components. II; 1 to 2 units. Coan, Fletcher, Krzywoblocki, McCloy, Torda, Stillwell.

Courses for Graduates and Advanced Undergraduates

311. Aerodynamics of Perfect Fluids. Fundamental equations, plane irrotational flow, vortex flow, combination fields of flow, Kutta-Joukowski theorem, application of conformal transformation to fields of flow, particle paths, fields of flow relative to axes fixed in the fluid, velocity potential, three-dimensional fields. I; ½ unit. Prerequisite: Aeronautical Engineering 212. Krzywoblicki.

312. Aerodynamics of Real Fluids. Characteristics of viscous and compressible fluids, including boundary layer theory, surface friction drag, turbulence, and two-dimensional subsonic and supersonic flows. II; ½ unit. Prerequisite: Aeronautical Engineering 212. Krzywoblocki.

314. Airplane Performance. The performance of conventional and unconventional aircraft developed on basic physical principles with additional empirical modifications where practical. Special attention is given to problems and methods of solution found in the industry. II; ½ unit. Prerequisite: Aeronautical Engineering 211. Stillwell.

316. Stability and Control. An introduction to dynamics of the airplane, airplane control, and airplane maneuverability. II; ½ unit. Prerequisite: Aeronautical Engineering 211; Mathematics 341 or 345. Ormsbee.

318. Airplane Propellers. Propeller blade action theory; aerodynamic propeller testing, effect of the propeller on airplane performance; blade design and stress analysis. II; ½ unit. Prerequisite: Aeronautical Engineering 212; Theoretical and Applied Mechanics 221. Stillwell.

320. Indeterminate Aircraft Structures. Virtual work and least work methods; analysis of fuselage rings and frames; indeterminate unsymmetrical space frameworks; application of energy methods to buckling of nonuniform columns. II; ½ unit. Prerequisite: Aeronautical Engineering 221. Coan.

331. Combustion, Fuels, and Lubricants. A study of the phenomena of combustion and combustion calculations; characteristics of fuels and lubricants for reciprocating engines, air-breathing jets, and rockets. I; ½ unit. Prerequisite: Mechanical Engineering 205. McCloy.

332. Aircraft Power Plant Design. The aerodynamic and thermodynamic design of aircraft power plants including reciprocating engines, turbo jets, pulse jets, ram jets, and rockets. II; ½ unit. Prerequisite: Aeronautical Engineering 231 and 331. McCloy, Torda.

391. Special Problems. Special problems relating to the theory, design, testing, operation, maintenance, or production of airframes or aircraft power plants. I; ½ to 1 unit. Prerequisite: Consent of instructor. Coan, Krzywoblocki, McCloy, Torda, Stillwell.

392. Special Problems. Special problems relating to the theory, design, testing, operation, maintenance, or production of airframes or aircraft power plants. II; ½ to 1 unit. Prerequisite: Consent of instructor. Coan, Krzywoblocki, McCloy, Torda, Stillwell.

AGRICULTURAL ECONOMICS

Graduate students may take work in agricultural economics leading to the degrees of Master of Science and Doctor of Philosophy. Work is offered in marketing, prices, statistics, economic policies, and finance, as applied to agriculture; farm management; land economics; international comparative agriculture; and rural sociology.

Graduate training in agricultural economics provides basic training for a wide range of employment, including agricultural economic teaching, research, or extension; a wide range of federal and state positions; foreign service; commercial marketing; professional farm management; credit with both public and private institutions; and with many private business institutions which employ men trained for positions requiring a thorough knowledge of the economics of agriculture.

Students who desire to secure degrees in agricultural economics are required to have completed either (1) a course of study equivalent to that required for the degree of Bachelor of Science in Agriculture at the University of Illinois, and including twelve hours of agricultural economics and economics, or (2) twelve hours of undergraduate economics and agricultural economics, and, in addition, at least eight hours in business organization and operation, history, political science, and sociology.

Students who desire to specialize in rural sociology should have had a minimum of six hours of sociology.

A grade-point average of 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training, is required for admission to graduate study. A student with a lower grade-point average may make up his deficiency by making satisfactory grades in twelve hours of additional undergraduate work in courses approved by the Head of the Department.

A candidate for the degree of Master of Science is required to register for at least two units in economics, including one unit of economic theory. For the degree of Doctor of Philosophy he must register for at least five units in economics, including two units of economic theory.

If approved by the Department of Agricultural Economics and the Dean of the Graduate College, the required work in economics may be treated as a part of the major field. Otherwise, the work in economics will be considered a first minor, in which case the program in that minor will require the approval of the Department of Economics (see requirements in economics for a minor in that field).

To take agricultural economics as a minor, the student must have had at least twenty hours of undergraduate work in economic and agricultural subjects.

Assistantships

A number of part-time staff positions, both in research and teaching, are maintained. These provide practical training in research and teaching while a student is pursuing his graduate training. In general, these assistantships will be granted to students with master's degrees or equivalent. Application blanks may be secured from the Department.

Graduate Teaching Faculty

Professors: H. C. M. Case (Head of Department), R. W. Bartlett, H. W. Hannah, R. R. Hudelson, P. E. Johnston, G. L. Jordan, D. E. Lindstrom, L. J. Norton, R. C. Ross, C. L. Stewart, E. J. Working.

Associate Professor: J. E. Wills.

Assistant Professors: R. A. Kelly, R. J. Mutti, A. B. Paul (on leave first semester 1950-1951), W. J. Wills.

Courses for Graduates

401. International Comparative Agriculture. Agricultural and major food problems of various countries; procedures, national and international, for improved standards. I; 1 unit. Stewart.

405. Economic Policies and Programs Affecting Agriculture. Economic analysis of state, national, and international policies and programs, including

proposed legislation having important bearing on the well-being of farm people. I; 1 unit. Prerequisite: One semester of graduate work, or consent of department. NORTON and others.

418. LAND ECONOMICS. Land classification methods and principles; land tenure systems in modern societies; land deterioration and restoration as private and public problems. II; 1 unit. STEWART.

425. FARM MANAGEMENT PRINCIPLES AND INVESTIGATIONAL METHODS. Analysis of farm business records; evaluation of measures of efficiency; planning the cropping system for increased income and control of erosion; use of economic information in fitting livestock to the farm plan; efficient use of labor and power; special research problems in farm organization. I; 1 unit. JOHNSTON.

426. FARM MANAGEMENT PRINCIPLES AND INVESTIGATIONAL METHODS. History and development of farm management in the United States; critical analysis of research methods; use of random sampling; application of selected economic principles. II; 1 unit. JOHNSTON.

436. PROBLEMS IN MARKETING AGRICULTURAL PRODUCTS. Factors influencing growth of markets; methods of cheapening and improving marketing processes; activities of government agencies; cooperative efforts. II; 1 unit. NORTON and others.

441. AGRICULTURAL PRICES AND STATISTICS. Sources and methods of collection and analysis of prices and other agricultural statistics; trend fitting, linear and curvilinear multiple correlation, analysis of variance and sampling. I; 1 unit. Prerequisite: An elementary course in statistics. WORKING.

442. AGRICULTURAL PRICES AND STATISTICS. Prices of agricultural products in the light of their history, value theory, monetary theory, and methods of statistical analysis. II; 1 unit. Prerequisite: Agricultural Economics 441, or equivalent. WORKING.

477. RURAL COMMUNITY ORGANIZATION. Same as Sociology 477. A study of rural community structure, functions, and processes, to give the student a concrete picture of how rural communities operate, and the forces which cause change in the group life of the people living in a rural community. I, II; 1 unit. LINDSTROM.

491. SEMINAR. Thesis course. All graduate students whose major is agricultural economics must register in the course, but only those writing theses acceptable for graduate degrees will be given credit. I; 1 to 4 units. CASE and others.

492. SEMINAR. Thesis course. All graduate students whose major is agricultural economics must register in the course, but only those writing theses acceptable for graduate degrees will be given credit. II; 1 to 4 units. CASE and others.

493. AGRICULTURAL ECONOMICS RESEARCH. Credit is conditional on completion of acceptable report of investigation. I; ½ to 2 units. CASE and others.

494. AGRICULTURAL ECONOMICS RESEARCH. Credit is conditional on completion of acceptable report of investigation. II; ½ to 2 units. CASE and others.

497. SEMINAR IN RURAL SOCIOLOGY. The use of the scientific method in the study of rural social problems; an analysis of methods used in rural sociological research; an analysis of problems studied in rural sociology; guidance in carrying on research in rural sociology. II; 1 unit. LINDSTROM.

Courses for Graduates and Advanced Undergraduates

302. Financing Agriculture. Capital and credit needs of farmers; agencies supplying credit needs; problems of borrowers and lenders. II; ½ unit. Prerequisite: Economics 102 and 103, or 108. Norton.

305. Agricultural Development and Policies. Agricultural development in the United States presented as a basis for analyzing the effectiveness of past public agricultural policies, delineating agricultural problems, and the need of developing sound agricultural policies in keeping with a sound national economy. I; ½ to 1 unit. Case.

312. Farm Appraisals. Same as Agronomy 312. Valuation of farm real estate; soils, crops, management, buildings, drainage, land titles, prices, and taxes in relation to value. Local field trips; estimated expense, $5. II; 1 unit. Prerequisite: Agronomy 201 and Agricultural Economics 120, or equivalent. Hudelson and others.

325. Advanced Farm Management. Planning the farm business for soil conservation and profit; fitting the livestock organization to the kind of crops produced and to market outlets; economic information for farm planning; measures of farm efficiency; labor and power problems. Field trips to study successful farms; estimated expense, $5. I; ½ unit. Prerequisite: Agricultural Economics 120. Buddemeier, Johnston.

331. Grain Grading and Marketing. Same as Agronomy 331 and Marketing 331. Factors affecting the quality of grain crops; standards employed in their classification and grading on the commercial market; laboratory practice in grain grading; a trip to a commercial grain grading laboratory; economic problems and market operations in grain marketing. I; ½ unit. Prerequisite: Agricultural Economics 130 and Agronomy 121, or consent of instructor. Dungan, Norton.

332. Marketing Livestock. Same as Marketing 332. Livestock market practice as applied in current marketing operations. II; ½ unit. Prerequisite: Agricultural Economics 130, Marketing 101, or consent of instructor. W. J. Wills.

333. Marketing Horticultural Products. Same as Horticulture 333 and Marketing 333. Producing and consuming areas; transportation; refrigeration; agencies, functions, and channels of distribution; cooperatives; marketing costs and factors affecting prices; standardization, grading, and inspection; marketing news service; perishable agricultural commodity act and other regulations; attempts to control surpluses; canning and other processing; foreign trade; consumer preference and expansion of domestic markets. I; ½ unit. Prerequisite: Agricultural Economics 130, or Marketing 101, or twelve hours of horticulture. Kelly.

334. Marketing Dairy Products. Same as Dairy Science 334 and Marketing 334. The dairy industry in our national economy; factors affecting per capita consumption; price plans and policies; expanding markets; trade associations and labor unions; looking ahead in the milk business. Inspection trip; estimated expense, $5. II; ½ unit. Prerequisite: Agricultural Economics 130, or Marketing 101, or twelve hours of dairy science or dairy technology. Bartlett.

341. Agricultural Statistics. A study of agricultural statistics and methods of statistics especially applicable to the fields of agricultural research. Students receiving credit in this course will not receive credit in Agriculture 216. I; ½ unit. Jordan.

342. Agricultural Prices. A study of the factors affecting prices of agricultural products; long-time, cyclical, seasonal, and other price movements; sources of information relating to production and demand factors; government activities as they relate to prices of agricultural products and problems in price analysis and forecasting. II; ½ unit. Prerequisite: Economics 102 and 103, or 108. Jordan.

AGRICULTURAL ENGINEERING

The Department of Agricultural Engineering offers graduate work leading to the Master of Science degree in Agricultural Engineering, with options for specialization in farm power and machinery, soil and water engineering, farm structures, rural housing and rural electrification.

Candidates for the master's degree must have had the equivalent of the undergraduate curriculum at the University of Illinois. This specifically includes basic training in theoretical and applied mechanics, and approximately twelve hours of advanced undergraduate design courses in civil engineering or mechanical engineering.

Students applying for admission must have a grade-point average of at least 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students are not admitted on limited status.

Fellowships and Assistantships

A few industrial fellowships are available. Requests for application forms should be directed to the Graduate College. Inquiries concerning part-time research or teaching assistantships should be directed to the Department of Agricultural Engineering.

Graduate Teaching Faculty

Professors: E. W. Lehmann (Head of Department), D. G. Carter, R. I. Shawl.

Associate Professors: R. C. Hay (on leave second semester 1950-1951), G. E. Pickard.

Courses for Graduates

491. Thesis. I; 1 to 2 units. Staff.

492. Thesis. II; 1 to 2 units. Staff.

493. Problems in Agricultural Engineering. Investigation and report on problems in farm machinery, farm power, rural electrification, soil and water engineering, and rural housing and farm structures. I; 1 unit. Prerequisite: Graduation in agricultural engineering or other engineering curricula, with credit in courses essential to the optional line of study; consent of head of department.

494. Problems in Agricultural Engineering. Investigation and report on problems in farm machinery, farm power, rural electrification, soil and water engineering, and rural housing and farm structures. II; 1 unit. Prerequisite: Graduation in agricultural engineering or other engineering curricula, with credit in courses essential to the optional line of study; consent of head of department.

Courses for Graduates and Advanced Undergraduates

332. Design of Agricultural Machinery. Survey of needs and requirements, layout of design, estimation of cost, and study of production problems. II; ½ unit. Prerequisite: Mechanical Engineering 241. Pickard.

341. Farm Power. Basic theory, analysis, and testing of internal combustion engines specifically for use in farm tractors and other farm power requirements. I; ½ unit. Prerequisite: Mechanical Engineering 202. Pickard.

351. Hydraulics of Soil and Water Conservation. Studies of watersheds, runoffs, cross sections of gullies; capacities of structures, terraces, and terrace outlets; design of structures; constructing terraces; machines used in erosion control; estimating costs and benefits of various methods of control. I; ½ unit. Prerequisite: Civil Engineering 115; Theoretical and Applied Mechanics 232 and 234; credit or registration in Civil Engineering 250; consent of instructor. Hay.

361. Farm Home Planning in Relation to Function. Same as Home Economics 361. A study of farmhouse conditions, needs, and functions; basic principles and their application to planning, remodeling, and building; financial and management factors; federal, state, and private housing programs. Lectures, discussions, and problems. II; ½ unit. Prerequisite: Home Economics 272, or consent of instructor. Carter.

371. Advanced Farm Structures. I; ½ unit. Prerequisite: Theoretical and Applied Mechanics 221 and 223; Civil Engineering 261. Carter.

393. Special Problems. Each student chooses a special problem for design, laboratory, or field work with special library research. I, II; ½ unit. Prerequisite: Approval of head of department.

AGRICULTURE

Candidates for the degree of Master of Science in Vocational Agriculture must earn four units in agriculture, two units in education, and two units in electives. Requirements are agriculture, four units; education, two units, including two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit. The courses in agriculture and the electives must be selected with the approval of the adviser. The electives may be in agriculture, in education, or, in exceptional cases, in other fields.

Students applying for admission must have a 3.5 grade-point average on that portion of the work which represents the last fifty per cent of the hours earned toward the bachelor's degree, exclusive of required courses in physical education and military training. Students on limited status will not be admitted to this program.

The advisers for candidates for this degree are Dean R. R. Hudelson, 104 Mumford Hall, and Professor H. M. Hamlin, 103 Gregory Hall.

Courses for Graduates

400. Methods of Agricultural Research. Principles and methods of research as applied to agricultural problems; initiating, conducting, and interpret-

ing agricultural experiments; preparation of reports and other publications; establishment and functions of state and federal experiment stations; problems of administration and supervision. Lectures, discussions, and assigned reading. II; ½ unit. CARROLL and others.

AGRONOMY

The Department of Agronomy offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy in Agronomy. The student may specialize in soil fertility, soil physics, soil biology, plant breeding, soil productivity and management, crop pathology, and crop production.

Students who have a grade-point average of at least 3.75 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training, may apply for admission to the Graduate College in Agronomy. Students will not be accepted on limited status.

Fifteen semester hours in agronomy and related subjects are prerequisite for a minor and five additional hours for a major; but students with an unusually broad and thorough training in science may be exempted from certain of these requirements.

Adequate preparation for graduate work in soils includes courses in physics, chemistry, geology, bacteriology, and mathematics; and in crops, courses in botany, chemistry, genetics, and statistics. A special pamphlet giving specific prerequisites and requirements may be obtained from the Head of the Department of Agronomy, 212 Davenport Hall.

A candidate for the Master of Science degree must present an acceptable thesis, unless this requirement is waived by petition, and pass an oral examination.

Candidates for the Doctor of Philosophy degree must meet the general requirements of the Graduate College regarding minors, foreign languages, theses, and special examinations.

Agronomy courses totaling four units will fulfill the requirements for a first minor for the Doctor of Philosophy degree.

Assistantships

Teaching and research assistantships become available in the department from time to time. Information concerning these positions may be obtained from the Head of the Department of Agronomy, 212 Davenport Hall.

Graduate Teaching Faculty

Professors: W. L. BURLISON (Head of Department), F. C. BAUER, O. T. BONNETT, R. H. BRAY, G. H. DUNGAN, R. F. FUELLEMAN, J. E. GIESEKING, R. W. JUGENHEIMER, B. KOEHLER, O. H. SEARS, E. H. TYNER, C. M. WOODWORTH.

Associate Professors: W. M. BEVER, E. B. EARLEY, L. T. KURTZ, S. W. MELSTED, R. T. ODELL, R. S. STAUFFER.

Assistant Professor: E. R. LENG.

Instructor: J. W. GERDEMANN.

Courses for Graduates

401. SOILS SEMINAR. I, II; ¼ unit. STAFF.

402. Chemical Properties of Soils: Their Relation to Soil Development and Plant Growth. Chemical properties of soils and soil materials; chemical aspects of soil development; their significance as factors in crop growth and plant nutrition. Discussion and assigned reading. I; 1 unit. Prerequisite: Adequate basic soils work. Melsted.

421. Crops and Plant Breeding Seminar. I, II; ¼ unit. Staff.

422. Pasture, Range, and Soil Conservation Research. Discussion and study of data and literature pertaining to pastures, range, and soil conservation; application of research methods to the evaluation of forage species in the management and utilization of pasture and range, and to soil conservation. II; 1 unit. Prerequisite: Agronomy 121 and 321 or 322. Fuelleman.

423. Theory and Analysis of Plant Breeding Problems. Genetics of crop plants; problems in selection and hybridization. II; 1 unit. Leng, Woodworth.

424. Principles Underlying the Production of Crops. Study of crop production by consideration of vegetative and reproductive functions; water relations, respiration, factors affecting quality of seeds and other crop products, weeds, root reserves, stabilization of crop yields, and plant hormones. II; 1 unit. Prerequisite: At least enough undergraduate credits in agronomy for a minor. Burlison, Dungan.

491. Thesis. I; ½ to 4 units.
(a) Soils. Bauer, Bray, Earley, Gieseking, Kurtz, Melsted, Odell, Sears, Stauffer.
(b) Crops. Bever, Bonnett, Burlison, Dungan, Fuelleman, Jugenheimer, Koehler, Leng, Woodworth.

492. Thesis. II; ½ to 4 units.
(a) Soils. Bauer, Bray, Earley, Gieseking, Kurtz, Melsted, Odell, Sears, Stauffer.
(b) Crops. Bever, Bonnett, Burlison, Dungan, Fuelleman, Jugenheimer, Koehler, Leng, Woodworth.

493. Research. I; ½ to 4 units.
(a) Soils. Bauer, Bray, Earley, Gieseking, Kurtz, Melsted, Odell, Sears, Stauffer.
(b) Crops. Bever, Bonnett, Burlison, Dungan, Fuelleman, Jugenheimer, Koehler, Leng, Woodworth.

494. Research. II; ½ to 4 units.
(a) Soils. Bauer, Bray, Earley, Gieseking, Kurtz, Melsted, Odell, Sears, Stauffer.
(b) Crops. Bever, Bonnett, Burlison, Dungan, Fuelleman, Jugenheimer, Koehler, Leng, Woodworth.

Courses for Graduates and Advanced Undergraduates

301. Genesis, Morphology, Classification, and Geography of Soils. Factors governing and processes active in soil development; physical and chemical properties of the soil groups of the world; classification and nomenclature of soil; soil geography. Field trips to be arranged; cost not to exceed $16. II; ½ unit. Prerequisite: Agronomy 201. Odell.

302. Role of Microorganisms in Soil Fertility. Microorganisms of the soils in relation to fertility; nitrogen fixation, assimilation, and preservation. I; ½ unit. Prerequisite: Agronomy 201. Sears.

303. Soil Productivity, Its Variation, Modification, and Conservation. Factors affecting soil productivity and its conservation; soil type response; influence of cropping systems, fertilizers, and management practices on productivity trends. II; ½ unit. Prerequisite: Agronomy 201. Bauer.

304. Metabolism of Soil Microorganisms. Chemistry and bacteriology of the nitrogen cycle; nitrogen fixation, nitrification, nitrate assimilation, denitrification, and synthesis of nitrogen compounds by microorganisms; relation of nitrogen to other cycles. II; ½ unit. Prerequisite: Bacteriology 104 and 105, or 320; Chemistry 132. Sears.

305. Physical Methods for Soil Conservation Studies. Physical properties of soils affecting conservation, productivity, and drainage; their investigation by field and laboratory methods. Lecture, discussion, and laboratory. I; ½ unit. Prerequisite: Agronomy 201. Offered in 1951-1952 and in alternate years. Stauffer.

306. Fertilizers and Their Soil Reactions. Fertilizer sources and materials. Chemical forms of elements in the soil, reactions of fertilizers in soils, determination of fertilizer needs, soil test methods, fertilizer application. I; ½ unit. Prerequisite: Agronomy 201. Bray.

307. Principles of Soil Conservation. National and local implications of soil conservation and its relation to farming systems, land management, climate, soil character, and farming operations. II; ½ unit. Prerequisite: Agronomy 121 and 201. Stauffer.

312. Farm Appraisals. Same as Agricultural Economics 312. Valuation of farm real estate; soils, crops, management, buildings, drainage, land titles, prices, and taxes in relation to value. Local field trips; estimated expense, $5. II; 1 unit. Prerequisite: Agronomy 201 and Agricultural Economics 120, or equivalent. Hudelson and others.

317. Plant Pathology. Same as Botany 317, Horticulture 317, and Plant Pathology 317. Causes, diagnosis, and treatment of plant diseases. I; ½ unit. Prerequisite: One year of plant science, including Botany 100.

321. Crop Production as Affected by the Environment. Response of crop plants to their habitat; study of climatic, physiographic, edaphic, and biotic factors of the environment in relation to crop growth; means by which crop hazards may be reduced. I; ½ unit. Prerequisite: Agronomy 121. Dungan.

322. Forage Crops and Pastures. Lectures and discussions of roughage production, forage crop characteristics and ecology, grasslands of farm and range as related to animal production and soil conservation. I, II; ½ unit. Prerequisite: Agronomy 121. Fuelleman.

323. Improvement of Farm Crops by Breeding. Heredity and variation in crop plants; effects of self-fertilization and cross-fertilization; principles and results of selection and hybridization in crop improvement. I, II; ½ unit. Prerequisite: Agronomy 121. Bonnett.

324. Principles of Field Plot Experimentation. Purpose, methods, and principles of field experimentation; interpretation of results. I; ½ unit. Leng.

325. Corn Breeding. Principles and procedures involved in developing, testing, and production of inbred lines and hybrids; production and processing of hybrid seed corn; genetics of corn. II; ½ unit. Prerequisite: Agronomy 323, or consent of instructor. Jugenheimer.

331. Grain Grading and Marketing. Same as Agricultural Economics 331 and Marketing 331. Factors affecting the quality of grain crops; standards

employed in their classification and grading on the commercial market; laboratory practice in grain grading; a trip to a commercial grain grading laboratory; economic problems and market operations in grain marketing. I; ½ unit. Prerequisite: Agricultural Economics 130 and Agronomy 121, or consent of instructor. DUNGAN, NORTON.

377. DISEASES OF FIELD CROPS. Same as Botany 377 and Plant Pathology 377. A study of the symptoms of the major field crop diseases, life histories of causal organisms, and methods of control. II; ½ unit. Prerequisite: Botany 317 or Agronomy 121, or consent of instructor. BEVER, GERDEMANN.

379. RESEARCH METHODS IN PLANT PATHOLOGY. Same as Botany 379, Horticulture 379, and Plant Pathology 379. Lectures and laboratory on the techniques for identification of plant diseases and their causal agents; for evaluation of plant protectants; for the study of the physiology of parasitism, and methods for planning research projects, evaluating data, and preparation of manuscripts for publication. I; ½ unit. Prerequisite: Botany 317. GERDEMANN, GOTTLIEB, THORNBERRY.

ANIMAL SCIENCE

(Including Animal Nutrition)

The Department of Animal Science offers graduate work leading to the degree of Master of Science and Doctor of Philosophy in Animal Science and in Animal Nutrition. For a major or a minor for the master's degree, the student may specialize in the general field of livestock or poultry production, or in the special fields of animal genetics and physiology, animal nutrition, or meats. For a major or minor for the doctor's degree he may specialize in animal genetics and physiology, animal nutrition, or in the general field of animal science.

The minimum grade-point average for admission to graduate study in the Department is 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students are not admitted on limited status.

A student who wishes to register for a minor in animal science for either the master's or doctor's degree must offer at least fifteen college credits in the field, including the principles of feeding, the principles of genetics, and livestock production and management, and he must have had an introductory course in organic chemistry. For a major, a student must offer at least five additional college credits in animal science or in courses related to his major field of specialization. To qualify for graduate study in the field of meats, a student must offer credit in Animal Science 104, 204, and 205, or their equivalents. Besides these general requirements, a student must have had the special training necessary for effective graduate study in the field of his chosen major.

Students who desire to take a minor for the doctor's degree in the general field of animal science must take Animal Science 305 and Animal Nutrition 401 if they have not previously taken these courses or their equivalents. Students registering for a major must also take Animal Nutrition 402 and will find it desirable to take Animal Science 405 or 406, or both.

For students with an unusually thorough training in science who wish to pursue graduate work in some special field of animal science from a non-agricultural viewpoint, the department may waive certain of the above requirements.

Introductory courses in physiology and zoology, and in mathematics prerequisite to or including statistics, are desirable preparation for graduate work in any phase of animal science or animal nutrition. A reading knowledge of French

and German, if acquired prior to registration in the Graduate College, will avoid the necessity of devoting time to these subjects while also carrying course work in the student's special field of interest.

Assistantships

Some research and teaching assistantships are available to students who can qualify for a major and who have a scholastic record of 4.0 or better. Applications should be addressed to the Head of the Department.

Graduate Teaching Faculty

Professors: L. E. Card (Head of Department), S. Bull, W. E. Carroll, T. S. Hamilton, W. G. Kammlade, H. H. Mitchell, E. Roberts, H. M. Scott, R. R. Snapp.

Associate Professors: R. M. Forbes, B. C. Johnson, A. V. Nalbandov, A. L. Neumann.

Assistant Professors: D. E. Becker, U. S. Garrigus, S. W. Terrill.

Courses for Graduates

400. Seminar. A review of current literature in the science of animal production. I, II; ½ unit. Staff.

401. Special Problems in Beef Production. A critical study of beef cattle experiments and the interpretation of their results. Intended to prepare students for positions with agricultural colleges and experiment stations and the United States Department of Agriculture. II; 1 unit. Prerequisite: Consent of instructor. Snapp.

402. Problems in Sheep and Wool Production and Research. Basic considerations in sheep and wool production and lamb feeding. Reports of research. Intended to aid in preparing students for positions in colleges, experiment stations, and related fields. II; ½ unit. Prerequisite: Consent of instructor. Garrigus.

403. Special Problems in Swine Research. A critical study and interpretation of experiments in swine feeding, breeding, and management. Intended to aid in preparing students for positions in colleges, experiment stations, and related fields. I; ½ unit. Prerequisite: Consent of instructor. Krider.

404. Special Problems in Poultry Husbandry. A discussion of research methods and findings in the field of poultry science, with some consideration of current industry problems. I; ½ unit. Prerequisite: Consent of instructor. Card.

405. Advanced Animal Genetics. Genetic theory, analysis of animal breeding problems, genetic results of selection and different systems of breeding. I; 1 unit. Roberts.

406. Physiology of Reproduction. Comparative physiology of reproduction and endocrinology of domestic and laboratory animals; fertility and sterility. Lectures and laboratory. II; 1 unit. Nalbandov.

407. Laboratory Methods in Animal Genetics. I or II; ½ to 1 unit. Roberts.

408. Laboratory Methods in Physiology of Reproduction. I or II; ½ to 1 unit. Nalbandov.

491. Research and Thesis. Work may be taken in the following subjects:

factors in livestock production, animal genetics, animal physiology, poultry, and meats. I; ½ to 4 units. STAFF.

492. RESEARCH AND THESIS. Work may be taken in the following subjects: factors in livestock production, animal genetics, animal physiology, poultry, and meats. II; ½ to 4 units. STAFF.

Courses for Graduates and Advanced Undergraduates

301. BEEF PRODUCTION. The principles of feeding and management of beef cattle; financial aspects of beef production; diseases and parasites of beef cattle; fitting cattle for show and sale. Lectures and discussions. I, II; ½ unit. Prerequisite: Animal Science 102. SNAPP.

302. SHEEP PRODUCTION. The sheep and wool industries; principles and practices of various phases of production. II; ½ unit. Prerequisite: Animal Science 102. GARRIGUS.

303. PORK PRODUCTION. The place of the swine enterprise on the farm; selecting, breeding, feeding, managing, and marketing of swine for greatest profit. I, II; ½ unit. Prerequisite: Animal Science 102. TERRILL.

304. POULTRY MANAGEMENT. Poultry science and practice with special reference to the place of the poultry enterprise on Illinois farms. I, II; ½ unit. Prerequisite: Animal Science 102. SCOTT.

305. ANIMAL GENETICS. The principles of heredity and their application to the problems of breeding. II; ½ unit. Prerequisite: Zoology 104, or equivalent. ROBERTS.

ANIMAL NUTRITION

The Division of Animal Nutrition offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy. The areas of study within the Division include the nutritive requirements of various species of animals and of man with particular reference to farm animals, the nutritive evaluation of farm feeds and human foods by chemical analysis and appropriate animal assays, and the functions of food energy, proteins, carbohydrates, fats, and minerals and the micronutrients, minerals and vitamins, in the animal organism.

The minimum grade-point average for admission to graduate study in animal nutrition is 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students are not admitted on limited status.

To qualify for a major in this field, a student must have an adequate training in chemistry (including five hours of organic chemistry, five hours of analytical chemistry, five hours of agricultural biochemistry or food analysis, and preferably five hours of physical chemistry) and in mathematics, including, or prerequisite to, statistics. Introductory courses in physiology and bacteriology, and in French and German, are desirable prerequisites for a major in animal nutrition. For a first minor, three hours of organic chemistry and five hours of agricultural biochemistry or of quantitative chemical analysis are required. For a second minor, only the prerequisites for the selected courses in animal nutrition need be offered.

Assistantships

Some research and teaching assistantships are available in animal nutrition to students who can qualify for a major in the field and who have made an

acceptable scholastic record (4.0 average or better) in undergraduate or graduate work. Applications should be addressed to the Head of the Department or to the Head of the Division.

Courses for Graduates

401. Principles of Animal Nutrition. Physical and chemical properties of nutrients; digestion and metabolism; functions and utilization of nutrients; principles involved in determining the nutritive requirements of animals. I; 1 unit. Prerequisite: Chemistry 132, 133, or 234. Hamilton.

402. Advanced Course in Animal Nutrition. A factorial study of the nutrient requirements of animals and man, and of the net nutritive values of feeds and food materials; comparative nutrition. II; 1 unit. Prerequisite: Animal Nutrition 401, or equivalent. Mitchell.

403. Laboratory Methods in Animal Nutrition. Technics of animal nutrition investigations. I, II; 1 unit. Hamilton, Forbes.

404. Methods of Vitamin Assay. A study of the principles underlying chemical, biological, and microbiological methods for the assay of vitamins, and the technical procedures that have been developed for this purpose. II; ½ to 1 unit. Prerequisite: Chemistry 350; consent of instructor. Johnson.

405. Animal Nutrition Seminar. I, II; ½ unit. Prerequisite: Animal Nutrition 402, or equivalent. Mitchell.

407. Vitamins in Nutrition. Nutritional requirements for individual vitamins; physiological function; metabolism and deficiency symptoms in different species. I; 1 unit. Prerequisite: Animal Nutrition 401 or Chemistry 350, or consent of instructor. Johnson.

408. Laboratory Methods in Vitamin Nutrition. Experiments designed to acquaint students with methods of research in the vitamin field. I, II; ¼ to 1 unit. Prerequisite: Animal Nutrition 407 or Chemistry 352, or consent of instructor. Johnson.

491. Research and Thesis. I; ½ to 4 units. Forbes, Hamilton, Johnson, Mitchell.

492. Research and Thesis. II; ½ to 4 units. Forbes, Hamilton, Johnson, Mitchell.

Courses for Graduates and Advanced Undergraduates

301. Introduction to Animal Nutrition. For students whose major is not animal nutrition, but who desire an introduction to the principles and practical applications of the science to animal feeding. II; ½ unit. Prerequisite: Animal Science 102; Chemistry 132. Forbes.

ARCHITECTURE

(Including Architectural Engineering)

The Department of Architecture offers graduate work leading to the degrees of Master of Science in Architecture and in Architectural Engineering. Majors are offered in architectural design (problems in advanced design, analytical studies of selected building types, or investigation of design factors and principles), advanced structural theory and design, and the history of architecture.

Students applying for admission must have a grade-point average of at least

3.5 for that portion of the work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Limited status students may be admitted.

The prerequisite for graduate work in architecture is a bachelor's degree in architecture equivalent in scope and standards to that of this University. The prerequisite for graduate work in architectural engineering is a bachelor's degree in architectural engineering. A major consists of five units and a minor of two units.

Assistantships

A few teaching assistantships are available to graduate students in architecture and architectural engineering. Inquiry regarding such appointments should be addressed to the Head of the Department.

Graduate Teaching Faculty

Professors: T. C. Bannister (Head of Department), C. C. Briggs, W. S. Kinne, Jr., A. K. Laing (on leave of absence 1950-1951), E. I. Love, N. D. Morgan, R. Newcomb, C. E. Palmer.

Courses for Graduates

401. Architectural Construction. Special problems. I, II; ½ to 2 units. Prerequisite: A degree in either option offered by the Department of Architecture. Palmer.

403. Architectural Construction. Theory and design. I, II; ½ to 2 units. Prerequisite: The degree in architectural engineering offered by the Department of Architecture, or the equivalent. Morgan.

404. Architectural Design. Advanced course. I, II; 1 to 3 units. Prerequisite: The degree in architecture offered by the Department of Architecture, or the equivalent. Briggs, Love.

406. Architectural History. Special research. I, II; ½ to 2 units. Prerequisite: A degree in either option offered by the Department of Architecture. Bannister, Laing, Newcomb.

Courses for Graduates and Advanced Undergraduates

337. Architectural Design. Advanced problems in modern buildings and building groups with complex requirements. I, II; 1½ units. Prerequisite: Architecture 236. Keith, Lindsay, Love, Williams.

338. Architectural Design. Advanced problems in modern buildings and building groups with complex requirements. I, II; 1½ units. Prerequisite: Architecture 337. Keith, Lindsay, Love, Williams.

347. Theory of Structures. Analysis of framework; industrial buildings; churches; arches; deflections; the elastic theory. I, II; 1 unit. Prerequisite: Architecture 246; Theoretical and Applied Mechanics 221; credit or registration in Architecture 257.

348. Advanced Structures. Theatres, assembly halls, and high buildings; continuous beams and trusses; rigid frames; statically indeterminate structures. I, II; 1 unit. Prerequisite: Architecture 347; credit or registration in Architecture 358. Morgan.

358. Reinforced Concrete Design. Reinforced concrete building design; analysis

of various types of modern fireproof construction. I, II; ½ unit. Prerequisite: Architecture 257; credit or registration in Architecture 348. MORGAN.

ART

The Department of Art offers graduate work leading to the degree of Master of Fine Arts. The prerequisite for graduate work for this degree is the equivalent of the undergraduate program required for the Bachelor of Fine Arts degree with concentration in the field to be pursued in graduate study.

Students applying for admission must have a grade-point average of 3.5 based on that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students will not be admitted on limited status.

Prospective students expecting to do graduate work in painting must submit examples of their work to the Graduate Committee of the Department in advance of registration. In the event that a prospective candidate for the Master of Fine Arts degree is found to be deficient in any phase of his undergraduate training, the Departmental Graduate Committee will require the student to take such undergraduate courses as will remove such deficiency.

Degree of Master of Fine Arts in Painting. To qualify for this degree in painting, each student is required to complete satisfactorily all of the following courses to the minimum of eight units: Art 493, one unit; Art 491, one to two units; Art 495, two to four units; Art 497, one-half to two units; and two courses in Advanced Art History, one and one-half units. A thesis must be submitted and approved.

Degree of Master of Fine Arts in Art History. Under some circumstances the Bachelor of Arts degree with a major in art history may be regarded as sufficient background for students desiring to do graduate work in art history. To qualify for this degree in art history, each student is required to complete satisfactorily all of the following courses to a minimum of eight units: Art 493, one unit; Art 491, one to four units; Art 497, one-half unit; Advanced Art History, one and one-half to three units; and elective, one to two units. A thesis must be submitted and approved.

Degree of Master of Fine Arts in Art Education. Candidates for this degree must earn four units in art, two of which are electives, three units in education, and one unit in an elective. Requirements are Advanced Art History, one unit; Art 493, one unit; Education 350, Curriculum Problems and Trends in Art Education, one unit; two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit. The elective courses in art and the other electives must be selected with the approval of the adviser. The elective may be in art, in education, or, in exceptional cases, in another field. Students seeking admission to the program in art education must meet the grade-point average required by the Department of Art. No students on limited status will be admitted.

A special departmental bulletin containing complete and current information will be forwarded upon request to the Head of the Department.

Assistantships

A limited number of teaching assistantships are available. Application should be made directly to the Department of Art.

Graduate Teaching Faculty

Professors: A. S. Weller (Head of Department), C. E. Bradbury, F. J. Roos.

Associate Professors: C. A. Dietemann, W. F. Doolittle, J. D. Hogan, H. A. Schultz.

Assistant Professors: M. B. Martin, E. C. Rae, N. Ziroli.

Courses for Graduates

491. Special Problems. Individual direction in research and guidance in writing theses. I, II; 1 to 2 units. Staff.

493. Seminar. Introduction to research. I; 1 unit. Doolittle, Roos, Schultz, Weller.

495. Painting Laboratory. Studio practice with concentration in one or more of the following areas: composition, portraiture, figure painting, landscape painting, and mural painting. I, II; 1 to 2 units. (This course may be repeated to a total of 4 units). Bradbury, Doolittle, Hogan.

497. Painting Techniques and Graphic Processes. The study of materials and techniques in painting and the graphic processes. I, II; ½ to 2 units. Staff.

Courses for Graduates and Advanced Undergraduates

311. Classical Art. Architecture, painting, sculpture, and minor arts of the Greek and Roman periods. I or II; ¾ unit. Prerequisite: Art 111 and 112 for art students; consent of instructor for others. Offered in 1950-1951 and in alternate years. Rae.

312. Medieval Art. Architecture, painting, sculpture, and minor arts of the Romanesque and Gothic periods. I or II; ¾ unit. Prerequisite: Art 111 and 112 for art students; consent of instructor for others. Offered in 1951-1952 and in alternate years. Rae.

313. Italian Renaissance Art. Architecture, painting, sculpture, and minor arts of Italy during the Renaissance. I or II; ¾ unit. Prerequisite: Art 111 and 112 for art students; consent of instructor for others. Offered in 1951-1952 and in alternate years. Weller.

314. Northern Renaissance Art. Architecture, painting, sculpture, and minor arts of France, Germany, Spain, and England in the sixteenth, seventeenth, and eighteenth centuries. I or II; ¾ unit. Prerequisite: Art 111 and 112 for art students; consent of instructor for others. Offered in 1951-1952 and in alternate years. Weller.

315. Art of the Nineteenth Century. Architecture, painting, sculpture, and minor arts of the nineteenth century in France, Germany, Spain, and England. I or II; ¾ unit. Prerequisite: Art 111 and 112 for art students; consent of instructor for others. Offered in 1951-1952 and in alternate years. Roos.

316. Art of the Twentieth Century. Architecture, painting, sculpture, and minor arts of the twentieth century in France, Germany, Spain, and England. I or II; ¾ unit. Prerequisite: Art 111 and 112 for art students; consent of instructor for others. Roos.

317. American Art. Architecture, painting, sculpture, and minor arts of the colonies and the United States. I or II; ¾ unit. Prerequisite: Art 111 and 112 for art students; consent of instructor for others. Roos.

318. Latin American Art. A study of the more important phases and periods of the visual arts of Latin America. I or II; ¾ unit. Prerequisite: Art 111 and 112 for art students; consent of instructor for others. Rae.

ASTRONOMY

The Department of Astronomy offers graduate work leading to the degree of Master of Science. The prerequisite for graduate study in astronomy is mathematics through calculus, a year's course in descriptive astronomy, and a course in college physics. Students applying for admission must have a grade-point average of 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students on limited status will not be admitted.

Graduate Teaching Faculty

Professor and Head of Department: R. H. Baker.

Courses for Graduates

401. Seminar. This course fulfills requirements for minors. Chiefly for graduate students in mathematics. It may be repeated. I, II; 1 unit. Prerequisite: Consent of instructor. Baker.

Courses for Graduates and Advanced Undergraduates

307. Celestial Mechanics. II; 1 unit. Prerequisite: Mathematics 142. Baker.

314. Observational Astronomy. Special problems. S; ½ to 1 unit. Prerequisite: Consent of instructor. Baker.

BACTERIOLOGY

The Department of Bacteriology offers graduate work leading to the Master of Science and Doctor of Philosophy degrees. Students electing bacteriology as a major for an advanced degree must have had chemistry through quantitative analysis and organic chemistry, and in addition, fifteen hours of physical or biological sciences. Mathematics through calculus is strongly recommended.

Students who have fulfilled these course requirements may apply for admission if they have a grade-point average of at least 4.0 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. No students on limited status will be admitted.

Candidates for the degree of Master of Science must pass a general written comprehensive examination toward the close of the second semester of residence.

Attention is called to the following courses, some of which must be elected for advanced degrees in bacteriology: Agronomy 304; Botany 372, 427, 471; Chemistry 350; Dairy Science 350, 450, 453; Horticulture 404; Veterinary Pathology and Hygiene 401, 493; Zoology 318, 418, 419.

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Graduate Teaching Faculty

Professors: H. O. Halvorson (Head of Department), I. C. Gunsalus, S. E. Luria, S. Spiegelman.

Associate Professors: F. M. Clark, G. I. Wallace.

Assistant Professors: A. F. Borg, C. M. Wilson.

Courses for Graduates

403. Physiology of Bacteria. Fermentation, growth, and death. I; 1 unit. Prerequisite: Thirty or forty hours of bacteriology and chemistry. Halvorson, Spiegelman.

404. Quantitative Analysis of Bacteriological Procedures. Quantitative analysis of counting methods, antibiotic assay methods, vitamin assay methods, analysis of growth and death curves, methods of measuring mutation frequency, and quantitative aspects of epidemiology. II; 1 unit. Prerequisite: Bacteriology 104, 105, and 403. Offered in 1951-1952 and in alternate years. Halvorson, Spiegelman.

405. Microbiological Genetics. Study of the phenomenon of heredity in microorganisms with particular reference to recent developments in the field. Examples from protozoa, yeasts, molds, bacteria, and viruses will be considered. Emphasis will be placed on critical examination and evaluation of methods. Implications of results for fundamental aspects of gene functions will be considered. II; 1 unit. Prerequisite: Bacteriology 403 and 404; genetics (Botany 322 or Zoology 351); mathematics through calculus, or consent of instructor. Offered in 1950-1951 and in alternate years. Spiegelman.

406. Microbiological Genetics Laboratory. Students will examine inheritance and adaptive phenomena in yeasts, molds, bacteria, and viruses. They will perform experiments designed to acquaint them with methods for following the inheritance of biochemical characters in both sexual and asexual phases. Experimental analysis of mutagenic agents and measurements of mutation rates will be included. II; 1 unit. Prerequisite: Registration in Bacteriology 405; consent of instructor. Offered in 1950-1951 and in alternate years. Spiegelman.

493. Research. I; ½ to 4 units. Staff.

494. Research. II; ½ to 4 units. Staff.

495. Discussions of Current Problems in Bacteriology. Required of all graduate students whose major is bacteriology. I; ½ unit. Prerequisite: Ten hours of bacteriology; consent of instructor. Staff.

496. Discussions of Current Problems in Bacteriology. Required of all graduate students whose major is bacteriology. II; ½ unit. Prerequisite: Ten hours of bacteriology; consent of instructor. Staff.

Courses for Graduates and Advanced Undergraduates

308. Food and Applied Bacteriology. Microbiology of foods; preservation, technology, analysis; food poisoning and food-borne intoxications. Laboratory, lectures, discussions, readings, and reports. II; 1 unit. Prerequisite: Bacteriology 104 and 105, or 320; consent of instructor. Clark.

309. Bacterial Nutrition and Vitamin Assays. Nutrition of microorganisms, bacterial nutrition, and metabolism; microbiological assays for vitamins.

Lectures and laboratories. I; 1 unit. Prerequisite: Bacteriology 104 and 105, or 320; fifteen hours of chemistry, including organic. CLARK.

310. EPIDEMIOLOGY. Spread and control of communicable diseases. Lectures, readings, and problems. II; ½ unit. Prerequisite: Bacteriology 104 or 320; consent of instructor. WALLACE.

320. GENERAL BACTERIOLOGY. Bacteria, structure, morphology, and systematic relationships; applications of bacteriology to general sanitation, agriculture, industrial fermentations, canning, and communicable disease. Lecture and laboratory. I, II; 1 unit. Students with credit in Bacteriology 104 and 105 will not be allowed credit for Bacteriology 320. Prerequisite: Two years of college chemistry; consent of instructor. BORG.

326. PATHOGENIC BACTERIOLOGY. A study of the pathogenic bacteria; classification, morphology, cultural requirements, and reactions; toxins, diagnostic tests, methods of differentiation and recognition, and the diseases bacteria cause. Lecture and laboratory. I; 1 unit. Prerequisite: Bacteriology 104 and 105, or 320. WALLACE.

327. IMMUNOLOGY AND SEROLOGY. A survey of the field of immunology; prevention of disease, diagnosis, and preparation and use of biologicals in the treatment of disease. Lecture and laboratory. II; 1 unit. Prerequisite: Bacteriology 326; consent of instructor. WALLACE.

BIOLOGICAL SCIENCES

Through the Division of the Biological Sciences (including bacteriology, botany, entomology, physiology, psychology, zoology) it is possible to arrange a program leading to the degree of Master of Science in the Biological Sciences. Students seeking admission to this Division must have a grade-point average of 3.5 for that portion of the work which represents the last fifty per cent of the hours earned toward the bachelor's degree, exclusive of required physical education and military training. No students on limited status will be admitted.

While the main emphasis is on botany and zoology, the candidate must have at least one unit in each of the following subjects: bacteriology, botany, entomology, physiology, and zoology. One unit in psychology (other than educational psychology) is strongly recommended. In planning his course of study the candidate should seek to attain the desired diversity by giving less emphasis to subjects in which he has already had considerable training. At least one unit must be taken in courses of graduate grade (courses numbered 400 and upwards). No thesis is required, but at least one course should be included in which individual problems are assigned. The Chairman of the Division of Biological Sciences is Professor O. Tippo, 309 Natural History Building.

Candidates for the degree of Master of Science in the Teaching of the Biological Sciences and General Science must earn four units in biological sciences, two units in education, and two units in electives. Requirements are biological sciences, four units; education, two units, including two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit. The courses in the biological sciences and the electives must be selected with the approval of the adviser. The electives may be in the biological sciences, in education, or, in exceptional cases, in other fields. A course in biological chemistry and one in experimental psychology are strongly advised. The adviser for candidates for this degree is Professor H. J. Fuller, 301 Natural History Building.

Students wishing to combine training for research in biology with graduate work in physics and chemistry may be interested in the curriculum offered under Physico-Chemical Biology (page 212).

Courses for Graduates and Advanced Undergraduates

331. Physico-Chemical Biology, Part I: Radiobiology. Same as Botany 331 and Physiology 331. Action of ionizing radiations on living organisms. I; 1 unit. Prerequisite: One year of biology, physics, chemistry, and mathematics. Offered in 1951-1952 and in alternate years. Quastler.

332. Physico-Chemical Biology, Part II: Photobiology. Same as Botany 332. Lecture and seminar course dealing with interaction of light and living matter (photosynthesis, phototropism, vision, bioluminescence). I; 1 unit. Prerequisite: One year of physics, chemistry, and biology; consent of instructor. Offered in 1950-1951 and in alternate years. Rabinowitch.

333. Physico-Chemical Biology, Part III: Electrobiology. Same as Botany 334 and Physiology 333. Potentials produced by and effects of potentials upon living organisms. Lectures, student reports, and demonstrations. II; ¾ unit. Prerequisite: Ten hours of biology; four hours of physical chemistry; ten hours of physics. Offered in 1950-1951 and in alternate years. Prosser.

354. Biophysics Laboratory. Same as Physics 354. Laboratory experiments in optics, electricity and nuclear physics designed to familiarize the student with the physical apparatus and techniques useful in biophysics. II; 1 unit. Prerequisite: General physics and calculus; consent of instructor. Rawcliffe.

BOTANY

The Department of Botany offers graduate work leading to the Master of Science and Doctor of Philosophy degrees. Candidates for advanced degrees must have had at least twenty hours of undergraduate work in botany, including courses 130, 160, and 304 or 120; or fifteen hours in botany (including courses 130, 160, and 304 or 120) and five hours in a related subject acceptable to the department. Graduate students who elect botany for minor credit must have fifteen hours in botany or ten hours in botany and five hours in a related subject acceptable to the department.

The following fields are available for specialization within the department: plant morphology, plant physiology (including photosynthesis), systematic botany, mycology, plant pathology, plant ecology, plant geography, cytology, genetics, cytogenetics, paleobotany, and plant anatomy.

Attention is called to courses in agronomy, bacteriology, chemistry, entomology, geography, geology, horticulture, mathematics, physics, physiology, plant pathology, and zoology, which are available for advanced students and offer a broad foundation for botanical work. Joint majors may be arranged in botany and agronomy, or botany and horticulture.

Admission to graduate work in the Department is granted to graduates who meet the admission requirements of the Graduate College, which are described in the early sections of this catalog. Specifically, the applicant's undergraduate grade-point average for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of physical education and military training, must be at least 3.5. No one will be admitted with limited status.

Graduate students may avail themselves of the University Herbarium which

contains some 300,000 specimens of vascular plants, bryophytes, fungi, and fossil plants. As outdoor laboratories, the University maintains two tracts of woodland, Brownfield Woods and William Trelease Woods. In addition, certain areas of Robert Allerton Park near Monticello are available for research and advanced study. Several ranges of greenhouses are maintained for experimental work with living plant materials, and laboratories well equipped for research in plant physiology including exceptional facilities for studies of photosynthesis are available for students in these fields. Recently, new laboratories of cytogenetics and genetics have been added and completely equipped. A new paleobotanical laboratory has also been installed. The College of Agriculture and the Agricultural Experiment Station offer unusual facilities to graduate students in the plant sciences. The Natural History Library with over 60,000 volumes offers excellent library facilities, with many bibliographical aids, including the Gray Herbarium Card Index of American Plants, the Index to American Botanical Literature of the Torrey Botanical Club, and the Tilden Index Algarum Universalis. In addition, the University maintains such facilities as an electron microscope, electron computer, betatron, ultra-centrifuge, and a radiocarbon laboratory for use in tracer studies.

Candidates for the master's degree in botany must take, in addition to the basic requirements listed above, one course in advanced morphology or systematic botany (Botany 320, 325, 344, 345, 360, or equivalent), one course in advanced physiology or ecology (Botany 333, 335, 381, 385, 386, or equivalent), and Library Science 433. Candidates for the master's degree in botany must take an examination covering the field of general botany. This is primarily an oral examination, although, at the option of the faculty, it may include a written section. It is given during the latter part of the second semester of residence.

Candidates for the degree of Doctor of Philosophy in Botany must take, in addition to the basic requirements listed above, the following courses (or they must be responsible for their content): one course in advanced systematic botany (Botany 360, or equivalent), one course in advanced morphology (Botany 320, 325, 344, or equivalent), one course in advanced physiology (Botany 333, 335, or equivalent), one course in ecology or plant geography (Botany 381, 385, 386, or equivalent), one course in genetics (Botany 322, or equivalent), one course in mycology (Botany 372, or equivalent), and one course in plant anatomy (Botany 345, or equivalent). Under special circumstances a student may petition the Botany Department to waive some of these requirements. All candidates for the Doctor of Philosophy degree in botany must pass a qualifying examination administered by the Department. This examination is given during the latter part of the year which follows the award of the master's degree. It is an oral examination, but may include a written section. It covers the general field of botany including physiology, morphology, ecology, systematic botany, genetics, etc. The purposes of this examination are: (1) to determine the deficiencies of the student so that he may be advised to correct them, and (2) to determine whether the student should be advised to continue his work for the Doctor of Philosophy degree.

Some time after the qualifying examination and the two foreign language examinations are passed, the candidate is given a preliminary examination administered by a committee appointed by the Dean of the Graduate College. This examination is designed to test the candidate's knowledge of the fields of his major and minor subjects. A final examination administered by a committee appointed by the Dean of the Graduate College is given at least two weeks before the time when the degree is conferred. This examination is primarily on the student's research but need not be confined to this.

Master's and doctor's theses are due in the office of the Department of Botany ten days before they are due in the Graduate College office. During this period theses are available for reading by faculty members, who may suggest changes to be made in theses before they are delivered to the Dean of the Graduate

College. Before writing their theses all graduate students are urged to obtain from the Graduate College office copies of "Instructions for Preparation of Theses."

Students are expected to secure a broad background in the whole field of botany, as well as in general biological principles. This may be achieved in part by courses, but an essential adjunct in the acquisition of this background is a program of individual reading and individual study. The following may be cited as examples of the type of subjects for private study: history of botany, philosophy of science (the student's attention is directed to Philosophy 328, a course in the philosophy of science, which may be taken or audited), and recent developments in the various branches of botany. In addition to courses required of all candidates, the student's adviser in a special branch of botany will recommend other courses to fit the student's special needs, both in his specialty and in allied subjects. Thus, the student in physiology will be advised to take certain courses in chemistry and physics, while a student in morphology or taxonomy may be instructed to enroll in geology. Students are urged to prepare at least one research paper for publication before completing work for the doctor's degree.

Students desiring to obtain a master's degree preparatory to high school teaching and not contemplating work for the Doctor of Philosophy degree should consider registration in the graduate teacher-training curriculum leading to the Master of Science degree in the Teaching of Biological Sciences and General Science (see page 53). The adviser for candidates for this degree is Professor H. J. Fuller, 301 Natural History Building.

Students who wish to major in plant pathology are referred to the section of this catalog devoted to plant pathology.

Students wishing to combine training for research in plant science or biology with graduate work in physics and chemistry may be interested in the curriculum offered under Physico-Chemical Biology (see page 212).

Fellowships and Assistantships

A number of fellowships are available in the Graduate College. For a description of application procedures, stipends, and requirements, refer to the beginning section of the catalog. In addition, a number of teaching and research assistantships are available. Half-time assistantships provide a stipend of $1,200 for a two-semester year and carry exemption from the payment of tuition. Graduate students with half-time appointments spend twelve hours a week teaching in general botany or other laboratories and the remainder of their time is devoted to graduate study. Half-time research assistants are expected to work twenty hours a week and the remainder of their time is spent in graduate study. To obtain application blanks for either teaching or research assistantships, address the Chairman of the Department of Botany.

Graduate Teaching Faculty

Professors: O. Tippo (Chairman of Department), J. T. Buchholz, R. Emerson, H. J. Fuller, G. N. Jones, E. I. Rabinowitch, K. B. Raper (second semester), M. M. Rhoades, A. G. Vestal.

Associate Professors: L. Shanor, W. N. Stewart.

Assistant Professors: J. R. Laughnan, J. F. Nance.

Courses for Graduates

402. Physiological Genetics. The probable nature of the gene and its action as deduced from studies on chromosome chemistry, genetically controlled reactions, cytoplasmic inheritance, mutation and gene analogues, with emphasis on higher plants and fungi. II; ½ or 1 unit. Prerequisite: Botany 322 and a course in organic chemistry. Laughnan.

404. Plant Virology. Same as Horticulture 404 and Plant Pathology 404. Fundamental concepts; classification, symptomology; infectivity; biological, chemical, and physical properties; techniques for transmission, staining, assay, filtration, and purification; control methods; sources of information; history of virology. II; 1 unit. Prerequisite: Consent of instructor. Offered in 1951-1952 and in alternate years. Thornberry.

410. Botanical Discussions. Required of all graduate students in botany. I, II; 0 to ¼ unit. Tippo.

413. Discussions in Plant Physiology. I, II; ¼ unit. Fuller, Nance.

414. Discussions in Plant Morphology and Systematic Botany. I, II; ¼ unit. Buchholz, Jones, Stewart, Tippo.

417. Discussions in Plant Pathology. Same as Horticulture 417 and Plant Pathology 417. Required for majors in plant pathology and as elective for graduate students in plant science. I, II; ¼ unit. Staff.

418. Discussions in Plant Ecology and Plant Geography. Developments in ecology and plant geography, with emphasis on one special division. II; ¼ unit. Prerequisite: Major in botany, entomology, geography, or zoology. Offered in 1950-1951 and in alternate years. Vestal.

419. Discussions in Photosynthesis and Related Topics. I, II; ¼ unit. Prerequisite: Consent of instructor. Emerson, Rabinowitch.

420. Cytogenetics. An advanced course in which emphasis is placed on the correlation of genetic data with chromosomal aberrations. I; 1 unit. Prerequisite: Botany 320 and 322, or equivalent. Rhoades.

421. Cytogenetics. An advanced course in which emphasis is placed on the correlation of genetic data with chromosomal aberrations. II; 1 unit. Prerequisite: Botany 320 and 322, or equivalent. Rhoades.

422. Discussions in Genetics and Cytogenetics. I, II; ¼ unit. Laughnan, Rhoades.

427. Discussions in Mycology. A seminar course designed for discussion of current research activities in the morphology, taxonomy, and physiology of fungi, especially the nonparasitic forms. I, II; ¼ unit. Prerequisite: Consent of instructor. Shanor.

433. Advanced Physiology of Growth, Responses, and Reproduction. I; 1 unit. Prerequisite: Botany 333, or equivalent. Offered in 1951-1952 and in alternate years. Fuller.

471. Advanced Mycology — Special Groups. Special groups of fungi and their activities are considered. Different groups for concentrated study may be selected each semester depending upon the student's interests in mycology. I, II; ½ unit. Prerequisite: Consent of instructor. Shanor.

472. Industrial Molds and Fermentations. The characteristics, relationships, and activities of molds of industrial importance are considered, with special emphasis on the Aspergilli, Penicillia, Mucorales, and other saprophytic fungi. II; ½ unit. Prerequisite: Consent of instructor. Raper.

493. Research. I; ½ to 4 units. Work may be taken in the following fields, subject to approval of one of the staff:

(a) Plant Morphology. Buchholz, Stewart.
(b) Plant Physiology. Fuller, Nance.
(c) Systematic Botany of Vascular Plants and Bryophytes. Jones.
(d) Mycology. Shanor.

(e) Plant Pathology. Anderson, Bever, Gottlieb, Koehler, Linford, Linn, Tehon, Thornberry.
(f) Plant Ecology or Plant Geography. Vestal.
(g) Plant Anatomy. Tippo.
(h) Photosynthesis. Emerson, Rabinowitch.
(i) Genetics and Cytogenetics. Rhoades, Laughnan.
(j) Paleobotany. Stewart.

494. Research. II; ½ to 4 units. Work may be taken in the following fields, subject to approval of one of the staff:
(a) Plant Morphology. Buchholz, Stewart.
(b) Plant Physiology. Fuller, Nance.
(c) Systematic Botany of Vascular Plants and Bryophytes. Jones.
(d) Mycology. Shanor.
(e) Plant Pathology. Anderson, Bever, Gottlieb, Koehler, Linford, Linn, Tehon, Thornberry.
(f) Plant Ecology or Plant Geography. Vestal.
(g) Plant Anatomy. Tippo.
(h) Photosynthesis. Emerson, Rabinowitch.
(i) Genetics and Cytogenetics. Rhoades, Laughnan.
(j) Paleobotany. Stewart.

Courses for Graduates and Advanced Undergraduates

300. Individual Topics. For seniors and first-year graduate students who wish to study individual problems and topics not assigned in other courses. Undergraduates may not offer more than five hours in Botany 300 and 301 toward a bachelor's degree, nor graduate students more than one unit in Botany 300 and 301 toward a master's degree. I; ¼ to ½ unit. Prerequisite: Botany 100; 10 hours of advanced work in botany or another biological science.

301. Individual Topics. For seniors and first-year graduate students who wish to study individual problems and topics not assigned in other courses. Undergraduates may not offer more than five hours in Botany 300 and 301 toward a bachelor's degree, nor graduate students more than one unit in Botany 300 and 301 toward a master's degree. II; ¼ to ½ unit. Prerequisite: Botany 100; ten hours of advanced work in botany or another biological science.

304. General Plant Morphology. A survey of the principles of plant morphology as exemplified by the various plant groups. I; ½ or 1 unit. Prerequisite: Botany 100, or Division of General Studies 131 and 132; consent of instructor. Buchholz.

306. Biology for Teachers. Same as Zoology 306. A teacher-training and review course for those engaged in or preparing for teaching general biology in high school. II; ¼ or ½ unit. Prerequisite: Botany 100; Zoology 101. Fuller, Matteson.

307. Fruit Diseases. Same as Horticulture 307 and Plant Pathology 307. Symptomatology; laboratory and field studies of representative diseases; control measures. I; ½ unit. Prerequisite: Botany 317 or 372. Offered in 1951-1952 and in alternate years. Anderson.

308. Vegetable and Canning Crop Diseases. Same as Horticulture 308 and Plant Pathology 308. Symptomatology; laboratory and field studies of rep-

resentative diseases; control measures. II; ½ unit. Prerequisite: Botany 317 or 372. Offered in 1950-1951 and in alternate years. LINN.

317. PLANT PATHOLOGY. Same as Agronomy 317, Horticulture 317, and Plant Pathology 317. Causes, diagnosis, and treatment of plant diseases. I; ½ unit. Prerequisite: One year of plant science, including Botany 100. LINFORD.

320. CYTOLOGY. Study of cell structure and cell division with special emphasis on plants. II; 1 unit. Prerequisite: One year of botany, including Botany 340. BUCHHOLZ.

322. GENETICS. A basic treatment of the facts and fundamental principles of genetics, with special emphasis on plants. I; 1 unit. Prerequisite: One year of botany. LAUGHNAN.

325. PALEOBOTANY. Same as Geology 325. The structure, phylogeny, and geological distribution of representative fossil plants. Two or three field trips. II; ½ or 1 unit. Prerequisite: Botany 100, or Division of General Studies 131 and 132 and Geology 101, or consent of instructor. Offered in 1950-1951 and in alternate years. STEWART.

331. PHYSICO-CHEMICAL BIOLOGY, PART I: RADIOBIOLOGY. Same as Biological Science 331. Action of ionizing radiations on living organisms. I; 1 unit. Prerequisite: One year of biology, physics, chemistry, and mathematics. Offered in 1951-1952 and in alternate years. QUASTLER.

332. PHYSICO-CHEMICAL BIOLOGY, PART II: PHOTOBIOLOGY. Same as Biological Science 332. Lecture and seminar course dealing with interaction of light and living matter (photosynthesis, phototropism, vision, bioluminescence). I; 1 unit. Prerequisite: One year of physics, chemistry, and biology; consent of instructor. Offered in 1950-1951 and in alternate years. RABINOWITCH.

333. PLANT PHYSIOLOGY. Physiology of plant growth, responses, and reproduction. I; ½ or 1 unit. Prerequisite: Botany 130. Offered in 1950-1951 and in alternate years. FULLER.

334. PHYSICO-CHEMICAL BIOLOGY, PART III: ELECTROBIOLOGY. Same as Biological Science 333 and Physiology 333. Potentials produced by and effects of potentials upon living organisms. Lectures, student reports, and demonstrations. II; ¾ unit. Prerequisite: Ten hours of biology; four hours of physical chemistry; ten hours of physics. Offered in 1950-1951 and in alternate years. PROSSER.

335. PLANT PHYSIOLOGY: METABOLIC TRANSFORMATIONS. II; ½ or 1 unit. Prerequisite: One year of botany, including Botany 130; one year of chemistry. NANCE.

340. HISTOLOGICAL TECHNIC. Survey of technics used in the preparation of plant tissues for microscopical examination. II; ½ or 1 unit. Prerequisite: One year of botany or ten hours of zoology. TIPPO.

344. SPERMATOPHYTES. Morphology of seed plants. II; ½ or 1 unit. Prerequisite: One year of botany including Botany 304. Offered in 1951-1952 and in alternate years. BUCHHOLZ.

345. PLANT ANATOMY. Study of the internal structure of vascular plants with special emphasis on function and evolutionary history. I; ½ or 1 unit. Prerequisite: One year of botany. TIPPO.

360. ADVANCED SYSTEMATIC BOTANY. Phylogenetic study of flowering plants; relationship of the principal orders and families; problems of nomenclature; identification of specimens. I; ½ or 1 unit. Prerequisite: Botany 160. Offered in 1951-1952 and in alternate years. JONES.

366. Field Botany. Identification and classification of native and naturalized flowering plants of eastern North America. S; ½ or 1 unit. Prerequisite: One course in botany; consent of instructor. Jones.

372. General Mycology. Structure, classification, and identification of fungi, including those of economic importance. II; 1 unit. Prerequisite: One year of botany, bacteriology, entomology, or zoology; consent of instructor. Shanor.

377. Diseases of Field Crops. Same as Agronomy 377 and Plant Pathology 377. A study of the symptoms of the major field crop diseases, life histories of causal organisms, and methods of control. II; ½ unit. Prerequisite: Botany 317 and Agronomy 121, or consent of instructor. Bever, Gerdemann.

379. Research Methods in Plant Pathology. Same as Agronomy 379, Horticulture 379, and Plant Pathology 379. Lectures and laboratory on the techniques for identification of plant diseases and their causal agents; for evaluation of plant protectants; for the study of the physiology of parasitism, and methods for planning research projects, evaluating data, and preparation of manuscripts for publication. I; ½ unit. Prerequisite: Botany 317. Gerdemann, Gottlieb, Thornberry.

381. Plant Ecology. Principles of ecology, exemplified by vegetation and environments of Illinois. I; ½ unit. Prerequisite: One year of botany. Vestal.

385. Plant Geography of North America. Vegetation regions and principal subdivisions; environments, plant cover, floras. I; ½ or 1 unit. Prerequisite: One year of botany. Offered in 1951-1952 and in alternate years. Vestal.

386. Plant Geography of Continents Other Than North America. Regions, vegetation-types, notable species. I; ½ or 1 unit. Prerequisite: One year of botany. Offered in 1950-1951 and in alternate years. Vestal.

388. Ecology: Plant Communities. Characteristics, types, development, and classification of communities. II; ½ or 1 unit. Prerequisite: One year of botany, including Botany 280 or 381. Offered in 1951-1952 and in alternate years. Vestal.

BUSINESS ORGANIZATION AND OPERATION

(Including Accountancy, Business, Business Law, Commercial Teaching, Management, and Marketing)

The Department of Business Organization and Operation, sometimes styled "applied economics," offers graduate work leading to advanced degrees in five different fields — accountancy, business, commercial teaching, management, and marketing. In a fourth field within the department, business law, no advanced degree is awarded but there are two courses which carry graduate credit and may be taken to satisfy requirements for a minor in other fields.

Students seeking admission in any area must have a grade-point average of 3.5 for that portion of the work which represents the last fifty per cent of the hours earned toward the bachelor's degree, exclusive of required physical education and military training. Students on limited status will not be admitted.

The degree of Master of Science is offered in the fields of accountancy, management, and marketing. The Doctor of Philosophy degree is offered only in accountancy and business. In satisfying the requirements for any of the degrees

offered in the department, a student is advised to take courses in economics to the extent it seems desirable to make up deficiencies in his undergraduate curriculum.

Candidates for any of the degrees granted within the department may select minors from any of the other fields within the department.

Assistantships

Teaching assistantships are occasionally available for highly recommended candidates for any of the graduate degrees sponsored by the department. For information write the Head of the Department.

Graduate Teaching Faculty

Professors: H. T. Scovill (Head of Department), A. G. Anderson, H. H. Baily, F. H. Beach, P. D. Converse, C. J. Gaa, P. M. Green, H. W. Huegy, A. C. Littleton, R. D. Loken, M. J. Mandeville, L. Morey, C. A. Moyer, H. L. Newcomer, F. A. Russell (on leave), C. H. Sandage, C. F. Schlatter, E. P. Strong, E. L. Theiss.

Associate Professors: A. C. Condon, R. I. Dickey, R. Dubin, F. M. Jones, R. K. Mautz, H. G. Wales.

Assistant Professors: H. E. Breen, R. B. Buchele, J. M. Carrithers, W. E. Thomas, N. D. Wakefield, N. Wedding.

ACCOUNTANCY

Candidates for the Master of Science or Doctor of Philosophy degree in Accountancy must have had the equivalent of twenty hours of undergraduate work in accountancy and at least one course each in principles of economics and finance. Graduate students in other departments who choose accountancy as a minor must present similar courses, with fifteen instead of twenty hours in accountancy as a minimum.

Courses for Graduates

424. Specialized Systems. Accounting procedures used by industrial and mercantile enterprises in handling their special problems; study of uniform accounting systems. I, II; 1 unit. Baily.

427. Accounting Techniques. Analytical survey of application of accounting techniques to various special fields; accounting principles and procedures applied to governmental organizations, contractors, banks, insurance companies, manufacturing concerns, and other business activities. Credit not allowed for this course in addition to credit for Accountancy 324, 341, and 366. I, II; 1 unit. Moyer, Theiss.

441. Governmental Accounting. Advanced study in accounting and other fiscal procedures of the federal government; state, county, and municipal governments; institutions. I; 1 unit. Morey.

466. Cost Accounting. A critical examination of cost accounting methods as to truth and expediency. I, II; 1 unit. Schlatter.

471. Accounting Reports. Form, contents, certificates, comments, consolidated statements, auditor's rights and responsibilities, published corporation reports. I, II; 1 unit. Scovill.

472. Auditing Standards and Techniques. A critical analysis of the techniques used in auditing; interrelation of audit standards, procedures, principles, and techniques; internal control as related to audit techniques; trends and developments in the accounting profession. I; 1 unit. Moyer.

473. System Design and Installation. Problems and procedures in connection with designing and installing accounting systems. I, II; 1 unit. Baily.

474. Income Tax Development. A theoretical and historical approach to the study of the development of federal income taxation, together with some research on tax cases and critical appraisal of the current law and proposals for its revision. I, II; 1 unit. Gaa.

481. Concepts and Principles. The fundamental structure of accounting theory is developed through the study of concepts characteristic of accounting and an examination of the literature dealing with the concise formulation of accounting principles. I; 1 unit. Littleton.

483. Income Determination. A study of the pros and cons of various unsettled issues involved in the calculation and disclosure of enterprise periodic income. II; 1 unit. Littleton.

487. Surplus and Dividends. The theories underlying the treatment of balance sheet items deserve close consideration in accounting, because the balance sheet reflects the effect of conflicting ideas about the bases for setting up restrictions on the freedom of directors to dispose of corporation assets as dividends. II; 1 unit. Littleton.

489. History of Accounting Theory. An examination of the more important aspects of accounting theory under the impact of changing conditions over four centuries, with major emphasis on the later developments. I; 1 unit. Littleton.

491. Thesis (A.M.). Private consultations regarding theses, and seminar discussions of progress made. I, II; 1 unit. Littleton and others.

492. Thesis (Ph.D.). Private consultations regarding theses, and seminar discussions of progress made. I, II; 1 unit. Littleton, Morey, Scovill.

Courses for Graduates and Advanced Undergraduates

308. Advanced Accounting. Reserves, sinking funds, actuarial methods, investments, partnerships, statements for special purposes, receiverships, consolidated balance sheets, foreign exchange. I, II; ½ unit. Prerequisite: Accountancy 106 and 108. Breen, Newcomer.

324. Accounting Systems. A discussion of the systems used by contractors, department stores, finance companies, building and loan associations, banks, insurance companies, brokers, water companies. I, II; ½ unit. Prerequisite: Accountancy 106 and 108. Baily, Carrithers.

341. Governmental Accounting. Accounts of institutions, municipalities, and of state and federal governments; organization; procedure, budget, accounts and records, reports, audits. I, II; ½ unit. Prerequisite: Accountancy 108. Borth.

362. Business Budgets and Accounting Control. Procedures used in the preparation of business budgets and the principles underlying these procedures. A complete budget is prepared by the student for a typical manufacturing company. I, II; ½ unit. Prerequisite: Accountancy 108 (Accountancy 106 for students majoring in industrial administration). Theiss.

366. Advanced Cost Accounting. Advanced accounting for production management. Principles and methods of accounting for managerial control of costs of production through the use of standards. I, II; ½ unit. Prerequisite: Minimum of nine hours of accountancy including Accountancy 106. Dickey, Schlatter, Theiss.

371. Auditing. Ethics of the accounting profession; auditing standards and procedures; programs of audit of various accounts; construction and indexing of working papers; report to clients. I, II; ½ unit. Prerequisite: Accountancy 308. Breen, Mautz.

372. Auditing Problems and Cases. Application of auditing principles in verification of financial statements; preparation of reports; case studies applicable to specific industries; current trends. I, II; ½ unit. Prerequisite: Accountancy 371. Mautz, Moyer.

374. Advanced Income Tax Procedure. Practical and theoretical training in the more common and important provisions of the federal income tax, advanced problems, tax case research and preparation. I, II; ½ to 1 unit. Prerequisite: Accountancy 274 and 308; senior standing. Gaa.

377. Advanced Problems. Consolidated statements, foreign subsidiaries, insurance, estates, theory, general statements. I, II; ½ to 1 unit. Prerequisite: Credit or registration in Accountancy 371. Moyer, Newcomer, Scovill, Wakefield.

378. C.P.A. Problems. Selected problems from C.P.A. examinations; analysis and revision of statements, partnerships, corporations, quasi-reorganizations, mergers, and others; theory, auditing, ethics. I, II; ½ to 1 unit. Prerequisite: Accountancy 377. Carrithers, Moyer, Newcomer, Scovill.

BUSINESS

The degree Doctor of Philosophy in Business is awarded to those who complete the subject-matter requirements listed below, in addition to the general requirements named in the forepart of this bulletin. The subject-matter requirements represent primarily a carefully selected group of subjects offered in the several fields of the College of Commerce and Business Administration.

Candidates for the degree should have a training such as that represented by graduation from an accredited college of commerce or school of business. Students who have not graduated from such college or school or from an institution offering an equivalent program must present a minimum of thirty hours in commerce subjects, including at least one course in each of the following: accountancy, economics, management, and marketing. Students lacking adequate preparation for admission may be admitted with the consent of the adviser or committee in charge, but must remove any deficiencies during the first year of residence by taking prescribed courses without credit toward the advanced degree. Those candidates who hold a master's degree in economics or business can usually complete the requirements in two years by appropriate synchronization of courses previously taken with those offered in this program.

In lieu of the provisions on major and minor subjects on page 21, candidates for the Doctor of Philosophy degree in Business will prepare themselves for examination in five fields including management, marketing, and economic theory. At least two other fields must be selected from subjects in business or economics. In addition, candidates may ask to be examined in one field outside the Department of Business Organization and Operation and the Department of Economics. For numbers and titles of courses available in economics and business, see the departments of Economics and Business Organization and Operation.

Inasmuch as the major fields for this degree cross departmental lines, admin-

istration of the work is in the hands of a committee. Correspondence relating to the degree should be directed to the Chairman of the Committee on the Doctor of Philosophy Degree in Business, 214 David Kinley Hall, Urbana, Illinois.

A limited number of fellowships and teaching assistantships are available for highly recommended candidates.

BUSINESS LAW

The two courses listed below may be taken for graduate credit by students whose advisers approve their selection as satisfying part or all of the requirements for a minor for the master's degree.

Courses for Graduates and Advanced Undergraduates

301. The Law of Security Transactions and Banking. Significant phases of law in the fields of pledges, chattel mortgages, conditional sales, suretyship, insurance, real property, banks and banking, and bankruptcy. Under real property, real estate mortgages, landlord and tenant and mechanics liens are considered as well as the general principles of real property. I, II; ½ to 1 unit. Prerequisite: Credit or registration in Business Law 202. Dillavou.

302. Wills, Estates, and Trusts. A study of the basic legal and management principles and practices involved in the planning and administration of wills, estates, and trusts. I; ½ to 1 unit. Prerequisite: Business Law 201 and 202.

COMMERCIAL TEACHING

The Department offers graduate work leading to the degree of Master of Science in Commercial Teaching. The work is part of an integrated five-year program for those preparing to become commercial teachers. The detailed requirements of the four-year curriculum are given in the bulletin on Undergraduate Study. The requirements of the fifth year are based on the educational background of the first four years, and an understanding of the coverage of that material is essential to a full appreciation of the requirements of the fifth year.

Candidates for the master's degree must earn credit as specified below. The grade-point average for admission is 3.5. No student on limited status will be admitted to this program.

(1) *Economics.* A sufficient number of hours in approved advanced undergraduate and graduate courses in economics must be taken to bring the total credit hours in this subject to not less than seventeen for the five years.

(2) *Business Law, Management, and Marketing.* A sufficient number of hours in approved advanced undergraduate and graduate courses in business law, management, and marketing must be taken to bring the total credit hours in this group of subjects to not less than seventeen for the five years.

(3) *Accountancy.* A sufficient number of hours in approved advanced undergraduate and graduate courses in accountancy must be taken to bring the total credit hours in this subject to not less than seventeen for the five years, excluding Accountancy 121.

(4) *Education.* Two of the following courses: Education 301, 302, 303, 304; and Education 311 and 312.

(5) *Commerce.* Sufficient work must be taken in the fifth year in courses recognized for graduate credit to bring the total hours in commerce courses to not less than sixty for the five years.

(6) *Electives.* Nine hours of approved advanced undergraduate and graduate

courses having general educational value, and of courses which bear directly on subjects taught in high schools.

The requirements of 1-5, above, can be satisfied with a minimum of twenty-three hours of credit. With the nine hours of electives (6), this makes a total of thirty-two hours in the fifth year, or 162 hours for the five-year program.

The maximum *required* credit hours for electives during the third, fourth, and fifth years in commerce fields are as follows: business law, management, and marketing, six hours; economics, nine hours; accountancy, five hours.

For the purpose of evaluating units of credit in graduate courses in terms of credit hours in undergraduate courses, one unit is considered the equivalent of four semester hours.

The adviser for candidates for this degree is Professor Earl P. Strong, 408 David Kinley Hall.

MANAGEMENT

Work may be done in the field of management for a major or a minor for the Master of Science degree, and for a minor for the Doctor of Philosophy degree. To do major work in this field, a student must have completed at least twenty hours of undergraduate work in marketing, management, economics, business law, or accountancy, at least six hours of which must have been in the field of management. To do minor work in this field a student must have had at least twelve hours of work in the subjects named above, of which three must have been in management.

Courses for Graduates

401. Scientific Management. A study of the development of modern industrial management and the principles and practices employed at the present time. I, II; 1 unit. Anderson, Mandeville.

402. Scientific Management. A study of the development of modern industrial management and the principles and practices employed at the present time. I, II; 1 unit. Anderson, Mandeville.

416. Problems in Business Policy. Advanced problems in policy evaluation, determination, execution, administration, and control. Policy objectives in integration of product, marketing, manufacturing, finance, and organization. I; 1 unit. Green.

448. Problems of Personnel Management. Same as Labor and Industrial Relations 448. An examination of the organization and administration of the personnel function in management. The course will deal with the relations of personnel administration to operating departments, and the scope of business and industrial personnel services. Analytical appraisal of policies and practices in selected areas of personnel administration such as selection and training, will be carried out through case studies and direct industrial contacts. Specific consideration will be given to problems up to and including placing the person on a job. I; 1 unit. Prerequisite: Economics 248, or equivalent; consent of instructor. Loken.

449. Problems of Personnel Management. Same as Labor and Industrial Relations 449. A seminar and laboratory course dealing with the problems and practices encountered by personnel managers subsequent to the employment process. Students will do field work in businesses and industries in the area on such topics as incentives, rating, employee services, and community relations. II; 1 unit. Prerequisite: Economics 240, 248, and Management 301, or Management 448. Loken.

491. Thesis. I, II; 1 unit. Anderson, Green, Mandeville.

Courses for Graduates and Advanced Undergraduates

301. Management in Manufacturing. Internal problems of production and efficient control in factories. I, II; ½ unit. Prerequisite: Management 101. Buchele, Mandeville.

311. Administrative Policies and Organization. Development of administrative organizations and the determination of policies for the integration of major activities of a business enterprise. I, II; ½ unit. Prerequisite: Management 101; Marketing 101. Mandeville.

312. Problems of Administration and Organization. Same as Labor and Industrial Relations 312. Problems of the individual and groups brought about by modern industrial organizations and techniques. Motivations for work and cooperation between executives and different economic and social groups. I, II; ½ unit. Prerequisite: Management 101, or equivalent. Dubin.

362. Job Wage and Contract Administration. An advanced, specialized treatment of the techniques, methods, and problems current in the wage and salary field. I, II; ½ to 1 unit. Prerequisite: Any one of the following courses or their equivalent: Psychology 145, 290, Economics 240, or 248. Buchele.

MARKETING

Work may be done in the field of marketing for a major or a minor for the Master of Science degree, and for a minor for the Doctor of Philosophy degree. To do major work in this field, a student must have completed at least twenty hours of undergraduate work in marketing, management, economics, business law, or accountancy, at least six hours of which must have been in the field of marketing. To do minor work in this field a student must have had at least twelve hours of work in the subjects named above, of which three must have been in marketing.

Courses for Graduates

401. Marketing Principles and Problems. Functional, commodity, and institutional methods of studying marketing with particular reference to the analysis and classifications of functions, commodities, and institutions. I, II; 1 unit. Converse.

402. Marketing Methods and Problems. Selected problems in the operation and management of market institutions. I, II; 1 unit. Converse.

407. Prices and Price Policies. An examination of the role of prices in our economy, and of price making under conditions of competition, monopoly, or monopolistic competition, with special emphasis on non-price competition; an examination of business pricing policies and of their acquisitive and social implications and significance. I, II; 1 unit. Huegy.

415. Merchandising Trends and Problems. The literature, trends, policies, and organization problems involved in retail merchandising. I; 1 unit. Jones.

421. Analysis of Consumer Markets. A study of consumers and their demands. I, II; 1 unit. Converse.

471. Sales Campaigns. Problems in managing the sales force. I, II; 1 unit. Beach.

472. Sales Campaigns. Problems in managing the sales force. I, II; 1 unit. Beach.

481. Advanced Advertising Principles. Same as Communications 481 and Journalism 481. Emphasis is placed on determination and understanding of the principles as related to the science, philosophy, and art of advertising. I; 1 unit. Sandage.

482. Research Methods in Advertising and Communications. Same as Communications 482 and Journalism 482. A critical study of research methods and their applications to the solution of advertising problems. II; 1 unit. Sandage.

491. Thesis. Thesis or independent study in the field of marketing. I, II; 1 unit. Converse and others.

Courses for Graduates and Advanced Undergraduates

305. Contemporary Problems in Marketing Management. The problems which marketing managers are currently facing and an analysis of the policy decisions they must make to operate effectively. I, II; ½ unit. Prerequisite: Marketing 101. Howard.

315. Retail Buying. Principles and procedures in buying for resale. Organization for buying, analysis of customer demand, model stock plans, sources of supply, resident buying, cooperative and central buying, foreign buying, selection of merchandise, and trade relations. I, II; ½ unit. Prerequisite: Marketing 211. Jones.

321. Marketing Research and Policies. The basic techniques used in business research and specific research projects, and how their findings are used in the formulation of marketing policies. I, II; ½ unit. Prerequisite: Marketing 101. Converse.

323. Problems in Business Research. Selected problems in the field of commercial research. I, II; ½ to 1 unit. Prerequisite: Marketing 321. Converse.

331. Grain Grading and Marketing. Same as Agricultural Economics 331 and Agronomy 331. Factors affecting the quality of grain crops; standards employed in their classification and grading on the commercial market; laboratory practice in grain grading; a trip to a commercial grain grading laboratory; economic problems and market operations in grain marketing. I; ½ unit. Prerequisite: Agricultural Economics 130 and Agronomy 121, or consent of instructor. Dungan, Norton.

332. Marketing Livestock. Same as Agricultural Economics 332. Livestock market practice as applied in current marketing operations. II; ½ unit. Prerequisite: Agricultural Economics 130, Marketing 101, or consent of instructor. W. J. Wills.

333. Marketing Horticultural Products. Same as Agricultural Economics 333 and Horticulture 333. Producing and consuming areas; transportation; refrigeration; agencies, functions, and channels of distribution; cooperatives; marketing costs and factors affecting prices; standardization, grading, and inspection; marketing news service; perishable agricultural commodity act and other regulations; attempts to control surpluses; canning and other processing; foreign trade; consumer preference and expansion of domestic markets. I; ½ unit. Prerequisite: Agricultural Economics 130, or Marketing 101, or twelve hours of horticulture. Kelly.

334. Marketing Dairy Products. Same as Agricultural Economics 334 and Dairy Science 334. The dairy industry in our national economy; factors

affecting per capita consumption; price plans and policies; expanding markets; trade associations and labor unions; looking ahead in the milk business. Inspection trip; estimated expense, $5. II; ½ unit. Prerequisite: Agricultural Economics 130, or Marketing 101, or twelve hours of dairy science or dairy technology. BARTLETT.

345. CREDITS AND COLLECTIONS. Retail and mercantile credit and collection principles and practices. I, II; ½ unit. Prerequisite: Marketing 101. HUEGY and others.

349. TRADE ASSOCIATIONS AND COMMERCIAL ORGANIZATIONS. Principles of trade association and Chamber of Commerce organization and management. II; ½ unit. Prerequisite: Marketing 101; Business Law 201.

372. ADVANCED SALESMANSHIP. An application of sales techniques to actual selling situations. Students make sales presentations, and critical appraisals are given. I, II; ¼ unit. Prerequisite: Marketing 271. BEACH, WALES.

373. SALES MANAGEMENT. Modern sales organization; selling problems of manufacturers, wholesalers, and retailers; management of salesmen. I, II; ½ unit. Prerequisite: Marketing 271. BEACH and others.

382. ADVERTISING COPY AND LAYOUT. Same as Journalism 382. Theory and practice of advertising copy writing and layout for newspaper, magazine, and direct mail; advertising planning for the local advertiser; use of consumer and market surveys, copy-testing methods, and advertising readership studies. I, II; 1 unit. Prerequisite: Journalism 204 and 281. SEIL.

383. ADVERTISING MEDIA. Same as Journalism 383. Analysis of the various advertising media in terms of markets served and factors to consider in the selection of media. I, II; ½ unit. Prerequisite: Marketing 281. FRYBURGER.

384. ADVERTISING CAMPAIGNS. Same as Journalism 384. Planning and execution of an advertising campaign; market and consumer research; development and allocation of advertising budget, organization and functions of advertising agency, choice of advertising appeals; selection of media; preparation of advertisements — copy and layout. I, II; ½ to 1 unit. Graduate students will not receive credit for both Marketing 384 and 387. Prerequisite: Marketing 382 and 383. MCCLURE, WEDDING.

385. ADVERTISING PROMOTION AND SALES. Same as Journalism 385. Sales problems, advertising promotion, advertising research, market research. I, II; ½ to 1 unit. Prerequisite: Marketing 382. MCCLURE.

386. RADIO ADVERTISING. Same as Journalism 386. Economics, standards, and ethics as applied to radio commercials; sponsorship, rates, and advertising techniques, including merchandising, marketing, servicing, and sales; preparation and presentation of radio advertising copy, measurements, and listener surveys. I, II; ½ unit. Prerequisite: Marketing 281. SANDAGE.

387. ADVERTISING POLICIES AND PROBLEMS. Same as Journalism 387. Analysis of actual advertising situations and study of how such situations were or might have been met. Consideration given to management and technical problems at both the national and retail levels. I, II; ½ to 1 unit. Graduate students will not receive credit for both Marketing 384 and 387. Prerequisite: Marketing 281. WEDDING.

CERAMIC ENGINEERING

The Department of Ceramic Engineering offers graduate work leading to the degrees of Master of Science in Ceramics, Master of Science in Ceramic Engineering, Doctor of Philosophy in Ceramics, and Doctor of Philosophy in Engineering.

The prerequisite for a major in graduate work in ceramics or ceramic engineering is proficiency in the undergraduate courses required for the degree of Bachelor of Science in the branch of the subject in which registration is desired, or substantial equivalents. An applicant's undergraduate grade-point average must be at least 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. No student will be admitted on limited status.

Candidates for the degree of Doctor of Philosophy in Ceramics must have had the equivalent of at least twenty-five semester hours of satisfactory courses in general, analytical, physical, and organic chemistry; also calculus, one year of college physics, and at least eighteen semester hours or their equivalent in acceptable ceramic courses.

Students with bachelor's degrees in chemistry, physics, or engineering may become candidates for the Master of Science or Doctor of Philosophy degrees but must make up deficiencies in ceramics by taking undergraduate courses at reduced credit. The student must, however, always be registered in at least one unit of graduate work.

The fields for majoring in ceramics or ceramic engineering are: refractories, porcelain enamels, glass, whitewares, structural clay products, and materials. The most common minors selected by graduate students in ceramic engineering are chemistry, physics, metallurgy, mathematics, geology, and engineering. A first minor may, however, be taken in the Department of Ceramic Engineering.

Students majoring in chemistry, physics, engineering, and other departments may take sole or second minors in ceramics or ceramic engineering. A second minor requires no ceramic prerequisite.

Fellowships

The following Graduate College fellowships are offered by the Department of Ceramic Engineering: Edward Orton, Jr., Fellowship; Owens-Illinois Fellowship; Titanium Alloy Manufacturing Company Fellowship; Lakefield Nepheline Syenite Fellowship.

Graduate Teaching Faculty

Professors: A. I. Andrews (Head of Department), R. L. Cook, R. K. Hursh, F. V. Tooley.

Associate Professor: A. W. Allen.

Assistant Professor: E. D. Lynch.

Courses for Graduates

401. Ceramic Chemistry. Silica, silicates, fusions, and phase relations. I; 1 unit. Prerequisite: Courses in chemistry and physics. Andrews.

402. Ceramics. Chemical and physical phenomena. II; 1 to 2 units. Prerequisite: Courses in physics and chemistry. Andrews.

403. Drying. Includes laboratory if taken for two units. I or II; 1 to 2 units. Prerequisite: Ceramic Engineering 203, or equivalent. Hursh.

A Student Removes a Glass "Frit" Pot from Its Cold Water Bath

404. Firing. Includes laboratory if taken for two units. I or II; 1 to 2 units. Prerequisite: Ceramic Engineering 204, or equivalent. Hursh.

405. Glass Technology. This course, designed for ceramic engineering graduates, is required for students majoring in glass technology, and may be elected by students majoring in some other branch of ceramic engineering. The course is concerned with the study of the properties of glass of importance in manufacturing and end use; emphasis is placed equally on research, control, development, and production aspects of the subject. I; 1 unit. Prerequisite: Ceramic Engineering 214 and 217, or 410. Tooley.

406. Glass Technology. This course, designed for ceramic engineering graduates, is required for students majoring in glass technology, and may be elected by students majoring in some other branch of ceramic engineering. The course, a continuation of Ceramic Engineering 405, completes the formal study of glass by taking up lesser known properties of importance in manufacture and end use. The course includes comprehensive literature surveys on selected topics and seminar type reports on classical researches in glass technology. Emphasis tends to the research point of view. II; 1 unit. Prerequisite: Ceramic Engineering 405. Tooley.

407. Porcelain Enamels. Advanced study in the composition, properties, and processing of porcelain enamels. I or II; 1 to 2 units. Prerequisite: Ceramic Engineering 216 and 256, or equivalent. Andrews.

408. Refractories. Includes laboratory if taken for two units. I or II; 1 to 2 units. Prerequisite: Ceramic Engineering 212, or equivalent. Allen, Hursh.

409. Special Ceramic Bodies and Glazes. Includes laboratory if taken for two units. I or II; 1 to 2 units. Prerequisite: Ceramic Engineering 211, or equivalent. Cook.

410. Glass Technology. This course is designed for graduates of physics, chemistry, and engineering (including chemical engineering), and foreign students, to be taken as a minor subject in graduate work, or to prepare the student for major graduate work in glass technology. Emphasis is placed on the research phases of the various topics to prepare the student more for research and development rather than production work in the field. I; 1 unit. Tooley.

411. Glass Technology. Continuation of Ceramic Engineering 410. II; 1 unit. Prerequisite: Ceramic Engineering 410. Tooley.

491. Thesis. Research in any of the branches of ceramics. I; 1 to 4 units. Andrews, Allen, Cook, Hursh, Lynch, Tooley.

492. Thesis. Research in any of the branches of ceramics. II; 1 to 4 units. Andrews, Allen, Cook, Hursh, Lynch, Tooley.

495. Materials and Special Problems. Conference and laboratory. I or II; 1 to 2 units. Andrews, Allen, Cook, Hursh, Lynch, Tooley.

CHEMISTRY

(Including Chemical Engineering)

The degrees offered in chemistry and chemical engineering are Master of Arts or Master of Science in Chemistry, Master of Science in Chemical Engineering, and Doctor of Philosophy in Chemistry or Chemical Engineering.

Students who have fulfilled the undergraduate course requirements as specified in the Graduate College Catalog may apply for entrance to the Graduate College in chemistry if they have a grade-point average of 4.0 for that portion of undergraduate work representing the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of hygiene, military, and physical education courses. Students on limited status will not be admitted.

Students who have obtained graduate credit in some other university may apply for admission provided, (1) their undergraduate records meet the above requirements, and (2) their grade-point averages in graduate work are at least 4.0. If a student's undergraduate record has not met the requirements specified above, the average in graduate work must be at least 4.25 in order to be admitted to the Graduate College in chemistry at the University of Illinois.

All students who receive permits to enter the Graduate College in chemistry or chemical engineering, regardless of whether they have had training beyond the bachelor's degree, must take registration examinations. These are offered in the week prior to the opening of the first semester for those entering in the summer or in the fall, and in the week prior to the opening of the second semester for those entering in February. Those who intend to major in any field of chemistry must take four examinations covering the normal undergraduate instruction in inorganic, analytical, organic, and physical chemistry; those who intend to specialize in chemical engineering must take two of the examinations in chemistry, one of which must be physical chemistry and the other of the student's own selection; and, in addition, two in chemical engineering covering the usual undergraduate instruction in that subject. The results of these registration examinations are not permanently recorded but serve merely to assist in the registration of students in the proper graduate courses. Students who demonstrate through these examinations that they are deficient will be required to register in one or more specific courses before taking more advanced work in a particular field. Most of these courses allow graduate residence credit. Students who have received permits to enter the Graduate College in chemistry or chemical engineering should contact the Department immediately to learn the dates when these registration examinations will be given and to obtain any other detailed information desired.

Students who intend to take graduate work for an advanced degree in chemistry or chemical engineering should include in their undergraduate preparation at least the equivalent of one full year of physics, one year of French, one year of German, and mathematics through differential and integral calculus. Any student without the necessary physics or mathematics may enter the Graduate College but will be required to spend part of his time in residence to remove the deficiency. In order to be admitted as a candidate for an advanced degree in chemistry a student must have had one year of college French or German (preferably German). Where the applicant has done two or three years of work in French or German in secondary school, the requirement will be considered to be met, provided at least one semester of the language more advanced than his secondary school work has been done in college. Four years of French or German completed in a secondary school will be accepted in lieu of any college work in the subject. An applicant who has a knowledge of French or German, but who lacks formal credentials, may be examined to determine his language status. Such an applicant should correspond with the Director of Admissions and Records with reference to his examination.

In meeting the language requirements for the degree of Doctor of Philosophy in Chemistry, a student may substitute Russian for French on the direct recommendation of the Department of Chemistry (and without formal petition), provided such recommendation is approved by the Dean of the Graduate College.

Candidates for an advanced degree in chemistry must have had the equivalent of twenty-five semester hours in chemistry, properly distributed.

Candidates for the Master of Arts or Master of Science degree with a major in chemistry must include among their courses Chemistry 240 and 241, or equivalent.

Candidates for the Doctor of Philosophy degree in any branch of chemistry must include among their courses Chemistry 240, 241, 342, and 343, or equivalent.

Before taking chemistry courses for graduate credit, graduate students whose major subject is in some department other than chemistry must have had the equivalent of fifteen semester hours in chemistry, including satisfactory work in general chemistry, qualitative and quantitative analysis, and elementary organic chemistry. Such students are advised to make selections from the following courses: Chemistry 240, 241, 315, 316, 327, 329, 336, 337, 342, 343, and 350. Courses of a more special nature will not, as a rule, be accepted for graduate work unless preceded by one of the above courses.

Those who intend to take a first minor in chemistry or any branch of chemistry toward the Doctor of Philosophy degree must include among their courses Chemistry 240 and 241, or must have had the equivalent. Graduate students in departments other than chemistry will be allowed graduate credit for Chemistry 240 and 241.

Candidates for the degree of Master of Science in the Teaching of Chemistry must earn four units in chemistry, two units in education, and two units in electives. Requirements are chemistry, four units; education, two units, including two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit. The courses in chemistry and the electives must be selected with the approval of the adviser. The electives may be in chemistry, in education, or, in exceptional cases, in other fields. For admission to this program the student must have the grade-point average required by the Department, and no limited status students will be admitted. The adviser for candidates for this degree is Professor J. C. Bailar, Jr., 107 Chemistry Annex.

For work in physical sciences, see page 211.

Fellowships and Assistantships

The Graduate College offers fellowships to worthy students including those who intend to specialize in chemistry or chemical engineering. Applications should be sent to the Dean of the Graduate College. In addition, the Chemistry Department has industrial or institutional fellowships and research assistantships for chemistry and chemical engineering students which vary in number from year to year. These appointments are awarded upon application, more often to those students who have already been at the University of Illinois for two semesters and who have demonstrated their ability in the Graduate College. The department also has several post-doctoral research assistantships available. Applications for research assistantships should be sent directly to the Chemistry Department.

Teaching assistantships in chemistry and chemical engineering are numerous. These are open to all students who are entering for graduate study. Applications for teaching appointments should be made directly to the Chemistry Department.

Graduate Teaching Faculty

Professors: R. Adams (Head of Department), L. F. Audrieth, J. C. Bailar, A. M. Buswell, H. E. Carter, G. L. Clark, E. W. Comings, D. T. Englis, R. C. Fuson, H. F. Johnstone, H. A. Laitinen, C. S. Marvel, T. E. Phipps, W. H. Rodebush, W. C. Rose, G. F. Smith, H. R. Snyder, F. T. Wall.

Associate Professors: H. G. Drickamer, R. B. Duffield, N. J. Leonard, G. T. Moeller.

Assistant Professors: E. R. Alexander, T. Baron, Virginia Bartow, R. K. Finn, L. M. Henderson, D. R. Martin, L. E. Miller, R. F. Nystrom, B. R. Ray, C. S. Vestling, J. W. Westwater, P. E. Yankwich.

Instructors: H. S. Gutowsky, R. M. Ross.

Courses for Graduates

402. Inorganic Chemistry. The less familiar elements and their relationship in the periodic system. Lectures, reports, and assigned readings. II; ¾ unit. Moeller.

404. Inorganic Chemistry. Advanced laboratory. Inorganic preparations and qualitative analysis involving the less familiar elements. II; ¼ to ¾ unit. Prerequisite: Credit or registration in Chemistry 402. Audrieth.

405. Inorganic Chemistry. Seminar. Required of all graduate students whose major is inorganic chemistry. I, II; ¼ unit. Audrieth.

406. Special Topics in Inorganic Chemistry. Discussions and reports. I, II; ¾ unit. Audrieth, Bailar, Martin.

421. Optical Methods of Chemical Analysis. I; ¾ unit. Prerequisite: General physics and chemistry equivalent to a major for a bachelor's degree. Englis.

422. Electrical Methods of Chemical Analysis. Lectures and laboratory. Polarography, potentiometric, amperometric, conductometric titrations, dielectric methods, etc. II; ¾ unit. Laitinen.

423. Qualitative Microanalysis. Lectures and laboratory. Micro-techniques, spot tests, and organic reagents. I; ¾ unit. Prerequisite: Chemistry 110 and 124, or equivalent. Laitinen.

424. Quantitative Analysis. Advanced principles, calculations, experimental methods, and applications. Required of all graduate students whose major or minor is analytical chemistry. II; ½ unit. Smith.

425. Analytical Chemistry. Seminar. Special topics in analytical chemistry. Required of all graduate students whose major or minor is analytical chemistry. I, II; ¼ to 1 unit. Prerequisite: Students must be taking major or first minor for the degree of Doctor of Philosophy in analytical division. Clark.

426. Applied X-rays. Lectures. I; ½ unit. Prerequisite: Training in physics and physical chemistry. Clark.

427. Applied X-rays. Lectures. II; ½ unit. Prerequisite: Training in physics and physical chemistry. Clark.

428. Applied X-rays. Laboratory. Optional laboratory work to accompany lectures in Chemistry 426 and 427. Training in operation of all types of X-ray apparatus with special emphasis on diffraction; experimental chemical identification and crystal structure analyses from powder and single crystal patterns. I; ½ unit. Prerequisite: Chemistry 426 or 427; training in physics, mathematics, and physical chemistry. Clark.

429. Applied X-rays. Laboratory. Optional laboratory work to accompany lectures in Chemistry 426 and 427. Training in operation of all types of X-ray apparatus with special emphasis on diffraction; experimental chemical identification and crystal structure analyses from powder and single

crystal patterns. II; ½ unit. Prerequisite: Chemistry 426 or 427; training in physics, mathematics, and physical chemistry. CLARK.

430. ORGANIC CHEMISTRY. Survey of organic chemistry designed for first-year graduate students. I, II; 1 unit. Prerequisite: One year (ten hours) of organic chemistry. FUSON.

432. ORGANIC CHEMISTRY. Advanced survey of organic chemistry (to follow Chemistry 430). II; 1 unit. Prerequisite: Chemistry 430, or equivalent. SNYDER.

433. ORGANIC CHEMISTRY. Optical isomerism, *cis-trans* isomerism, tautomerism, chemistry of the carbohydrates, etc. I; ¾ unit. Prerequisite: Chemistry 430 and 432, or consent of instructor. LEONARD.

434. ADVANCED ORGANIC SYNTHESIS. I, II; ½ to 1 unit. ALEXANDER, MILLER.

435. ORGANIC CHEMISTRY. Seminar. Current literature in organic chemistry. I, II; ½ unit. Prerequisite: Consent of instructor. In most cases, students must be doing research in organic chemistry and be registered for the degree of Doctor of Philosophy. ADAMS.

436. ORGANIC CHEMISTRY. Quantitative organic analysis and newer methods in organic laboratory procedure. A laboratory course designed to acquaint students with newer research techniques. I, II; ½ to 1 unit.

440. PHYSICAL CHEMISTRY. Survey of physical chemistry for graduate students. I, II; ¾ to 1 unit. Prerequisite: Chemistry 240 and 342, or equivalent. PHIPPS, WALL.

441. CHEMICAL THERMODYNAMICS. Fundamental laws of thermodynamics and calculation of thermodynamic quantities. I; 1 unit. Prerequisite: Elementary physical chemistry. WALL.

442. CHEMICAL THERMODYNAMICS. Fundamental laws of thermodynamics and calculation of thermodynamic quantities. II; 1 unit. Prerequisite: Elementary physical chemistry. WALL.

443. MOLECULAR STRUCTURE. The structure of molecules and relationships to physical properties. II; 1 unit. Prerequisite: Chemistry 342. YANKWICH.

444. PHYSICAL CHEMISTRY. Kinetic theory in statistical mechanics. I or II; ¾ unit. Prerequisite: Chemistry 441 and 442. Offered in 1950-1951 and in alternate years, alternating with Chemistry 446. PHIPPS.

445. PHYSICAL CHEMISTRY. Seminar. I, II; ½ to ¾ unit. Prerequisite: Chemistry 240, 342, 441, and 442. RODEBUSH.

446. QUANTUM CHEMISTRY I. Introduction to quantum mechanics and its application to chemical problems. Lectures. I; ¾ unit. Prerequisite: Chemistry 443; consent of instructor. Offered in 1951-1952 and in alternate years, alternating with Chemistry 444. GUTOWSKY.

447. QUANTUM CHEMISTRY II. A continuation of Chemistry 446; primarily the application of quantum theory of molecular structure and molecular spectra. Lectures. II; ¾ unit. Prerequisite: Chemistry 443, or equivalent; Chemistry 446. Offered in 1951-1952 and in alternate years, alternating with Chemistry 448. GUTOWSKY.

448. CHEMICAL KINETICS. Chemical reaction and the theory of rate processes. Lectures. II; ¾ unit. Prerequisite: Chemistry 444, or equivalent; consent of instructor. Offered in 1950-1951 and in alternate years, alternating with Chemistry 447. GUTOWSKY.

450. Biochemistry. Lectures and readings. Chemistry of intermediary metabolism. II; ¾ unit. Prerequisite: Chemistry 350, or equivalent. Rose.

452. Biochemistry. Chiefly laboratory. Difficult biochemical preparation; analytical methods. I, II; ½ to 1 unit. Prerequisite: Chemistry 350, or equivalent. Rose.

455. Biochemistry. Seminar. Current literature. Required of all graduate students whose major is biochemistry. I, II; ¾ unit. Prerequisite: Chemistry 350, or equivalent. Rose.

485. Chemistry of Water Treatment. Seminar. Special problems and new developments in sanitary chemistry. I, II; ¼ to 1¼ units. Prerequisite: Graduate standing in science or engineering. Buswell.

490. Research. Candidates for the Master of Arts or Master of Science degree who elect research are required to present a thesis. A thesis is always required of students working toward the degree of Doctor of Philosophy. Not all candidates for thesis work necessarily will be accepted. Students whose major is in departments other than chemistry must receive permission from the Head of the Chemistry Department to register in this course. I, II; ¼ to 4 units. Work may be taken in the following fields, subject to the approval of one of the qualified staff members:

Analytical Chemistry. Clark, Englis, Laitinen, Smith.

Applied X-rays and Electron Microscopy. Clark.

Biochemistry. Carter, Henderson, Rose, Vestling.

Ceramic Chemistry. Andrews.

Food Chemistry; Phytochemistry. Englis.

Inorganic Chemistry. Audrieth, Bailar, Laitinen, Martin, Moeller.

Organic Chemistry. Adams, Alexander, Fuson, Leonard, Marvel, Miller, Snyder.

Physical Chemistry. Gutowsky, Phipps, Ray, Rodebush, Wall, Yankwich.

Polarography and Related Topics. Laitinen.

Water Chemistry; Zymochemistry. Buswell.

492. Chemical Literature and Reference Work. I; ¼ unit. Bartow.

Courses for Graduates and Advanced Undergraduates

315. Inorganic Chemistry. Nuclear and extra-nuclear atomic structures and their relation to the properties of the elements and of their compounds; types of bonding; survey of the periodic relationships, preparation, and applications of the elements and their compounds. I, II; ¾ unit. Prerequisite: Fifteen hours of credit in chemistry courses exclusive of courses numbered below 110. Martin.

316. Inorganic Chemistry. Preparation of typical inorganic compounds illustrating special and more advanced techniques. I, II; ½ unit. Prerequisite: Credit or registration in Chemistry 315. Martin, Moeller.

325. Analytical Chemistry. A survey course for advanced undergraduate and graduate students requiring further training and review in analytical chemistry. II; ¾ unit. Laitinen.

326. Chemical Analysis and Treatment of Water. Chemical and instrumental methods for analysis of water and determination of quality. Chemical principles and processes in water purification and conditioning. Relationship

of chemistry of water to municipal and industrial use. I; ¾ unit. Prerequisite: Chemistry 124. ENGLIS.

327. SPECIAL AND INSTRUMENTAL METHODS OF ANALYSIS. Gas analysis; electrometric titration, optical methods, and other advanced analyses. I, II; ¾ unit. Prerequisite: Chemistry 124, 234, 240, and 241. SMITH.

328. CHEMICAL MICROSCOPY AND CRYSTALLOGRAPHY. The theory and practice of the use of the optical microscope in chemical identification and analysis, and in the characterization and classification of crystals; principles of crystallization, crystal growth, polymorphism. I; ¾ unit. Prerequisite: Chemistry 124 and 240; consent of instructor. CLARK.

329. FOOD ANALYSIS. Quantitative organic analysis of food products; alcohols, carbohydrates, fats and oils, cereals, nitrogenous bodies, preservatives, and colors. II; 1¼ units. Prerequisite: Chemistry 122 or 124, and 133 or 234. ENGLIS.

336. ORGANIC CHEMISTRY. Second course. Lectures and recitations. I, II; ¾ unit. Prerequisite: Chemistry 124 and 234. MARVEL.

337. ORGANIC CHEMISTRY. Laboratory experiments in organic chemistry. I, II; ½ unit. Prerequisite: Chemistry 234 and 336. MILLER.

338. SYSTEMATIC IDENTIFICATION OF ORGANIC COMPOUNDS. I, II; ¾ unit. Prerequisite: Chemistry 336 and 337, or equivalent. SNYDER.

342. ELEMENTARY PHYSICAL CHEMISTRY. Lectures. I, II; ¾ unit. Prerequisite: Chemistry 240. GUTOWSKY, PHIPPS.

343. ELEMENTARY PHYSICAL CHEMISTRY. Laboratory to accompany Chemistry 342. I, II; ¼ unit. Prerequisite: Chemistry 240 and 241; credit or registration in Chemistry 342. GUTOWSKY.

344. PRINCIPLES OF CHEMICAL THERMODYNAMICS. Thermodynamics and free energy calculations. I, II; ¾ unit. Prerequisite: Chemistry 240 and 342, or consent of instructor. PHIPPS, RODEBUSH.

345. COLLOID AND SURFACE CHEMISTRY. Physical chemistry of colloid systems; properties of surfaces and inter-faces; applications. I; ¾ unit. Prerequisite: Chemistry 336 and 342, or consent of instructor. RAY.

346. ATOMIC STRUCTURE AND VALENCE. Advanced physical chemistry. I or II; ½ unit. Prerequisite: Chemistry 240 and 342. YANKWICH.

349. COLLOID AND SURFACE CHEMISTRY. Laboratory. Quantitative experiments in colloid and surface chemistry. I, II; ¼ unit. Prerequisite: Credit or registration in Chemistry 345, or consent of instructor. RAY.

350. BIOCHEMISTRY. Chemistry of carbohydrates, lipids, and proteins; the alimentary processes, blood, tissues, and metabolism; quantitative analysis of gastric contents, blood, and urine. Clinical aspects for prospective students of medicine. Lectures, conferences, laboratory, and readings. I, II; 1¼ units. Prerequisite: Chemistry 122 or 124, and 133 or 234. CARTER, HENDERSON, ROSE, VESTLING, and others.

351. TECHNIQUES OF BLOOD ANALYSIS AND THEIR APPLICATIONS. II; ¾ unit. Prerequisite: Chemistry 350. CARTER.

352. BIOCHEMISTRY OF VITAMINS AND HORMONES. II; ¾ unit. Prerequisite: Chemistry 350. CARTER.

395. HISTORY OF SCIENCE WITH PARTICULAR REFERENCE TO CHEMISTRY. I; ¼ unit. Prerequisite: Twenty hours of laboratory science. BARTOW.

397. Radiochemistry. Properties of radioactive nuclei, nature of radioactivity, nuclear reactions, detection equipment, and tracer technique. Lectures. I, II; ½ unit. Prerequisite: Chemistry 240 and 241. Duffield.

398. Radiochemistry. Laboratory to accompany Chemistry 397. I, II; ¼ unit. Prerequisite: Chemistry 240 and 241; credit or registration in Chemistry 397; consent of instructor. Duffield.

CHEMICAL ENGINEERING

The Department of Chemistry offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy in Chemical Engineering. Candidates for these degrees should have had undergraduate training comparable to that offered at the University of Illinois, including mathematics through calculus, and year courses in physics, mechanics, and electrical engineering. Students who enter without the usual engineering courses prescribed in the undergraduate chemical engineering curriculum will be required to make up their deficiencies to the extent prescribed by their adviser.

Candidates for an advanced degree in chemical engineering must have had the equivalent of twenty-five hours in chemistry, including organic and physical chemistry.

A reading knowledge of German and French or Russian is recommended for all graduate students in chemical engineering. In meeting the language requirements for the degree of Doctor of Philosophy in Chemical Engineering, a student may substitute Russian for French on the direct recommendation of the Department of Chemistry (and without formal petition), provided that such recommendation is approved by the Dean of the Graduate College.

Candidates for the Master of Science degree in Chemical Engineering must include Chemical Engineering 387 and 388 among their courses.

A student who chooses chemical engineering as a minor must take at least two units of work in this subject for the Master of Science degree, or four units for the Doctor of Philosophy degree.

Courses for Graduates

463. Evaporation, Drying, Humidification, and Dehumidification. Lectures. I; ¾ unit. Prerequisite: Chemical Engineering 373. Offered in 1951-1952 and in alternate years. Johnstone.

464. Absorption and Extraction. Lectures. I; ¾ unit. Prerequisite: Chemical Engineering 373. Offered in 1950-1951 and in alternate years. Johnstone.

465. Chemical Engineering. Seminar. Required of all graduate students whose major is chemical engineering. I, II; ¼ unit. Prerequisite: Chemical Engineering 373. Johnstone.

466. Filtration and Separations. Properties of particulate matter: aerosols, suspensions, slurries, and packed beds; methods of comminution and separation. Lectures and problems. II; ¾ unit. Prerequisite: Chemical Engineering 373. Offered in 1950-1951 and in alternate years. Johnstone.

467. Distillation. Application of principles of distillation to binary and multicomponent mixtures including a discussion of azeotropic and extractive distillation. II; ¾ unit. Prerequisite: Chemical Engineering 373. Offered in 1951-1952 and in alternate years. Drickamer.

468. Advanced Plant Design. Problems in equipment design and plant layout. Lectures and conferences. II; ¾ unit. Prerequisite: Chemical Engineering 373, 387, and 388. Offered in 1951-1952 and in alternate years. Johnstone.

469. Industrial Reaction Kinetics and Catalysis. The prediction of physical properties and absolute reaction rates from theory. The application of these to the design of industrial reactors. II; 1 unit. Prerequisite: Graduate standing in chemical engineering; consent of instructor. Offered in 1950-1951 and in alternate years. Drickamer.

490. Research. Candidates for the master's degree who elect research are required to write a thesis. A thesis is always required for the degree of Doctor of Philosophy. Not all candidates for thesis work necessarily will be accepted. Any student whose major is in another department must receive permission from the Head of the Department to register in this course. I, II; ¼ to 4 units. Baron, Comings, Drickamer, Johnstone, Straub, Swann, Westwater.

Courses for Graduates and Advanced Undergraduates

363. Unit Operations in Food Technology. Same as Food Technology 363. Fundamentals of heat transfer, fluid flow, extraction, drying, and other unit operations especially adapted to the food and biochemical industries. Primarily for students in chemistry and food technology; not open to majors in chemical engineering. Lectures and problems. I; ¾ unit. Prerequisite: Chemistry 240 or Chemistry 247 and one year of calculus. Finn.

370. Chemical Engineering Thermodynamics. The fundamental concepts and laws of thermodynamics; primarily for students in chemical engineering. II; ½ unit. Prerequisite: Chemical Engineering 261; Chemistry 240. Drickamer.

371. Principles of Chemical Engineering. Scientific principles in unit operations of chemical engineering. Lectures, problems, and quizzes. I, II; 1 unit. Prerequisite: Chemical Engineering 370, or consent of instructor. Baron.

372. Unit Operations Laboratory. First course. To accompany Chemical Engineering 371. I, II; ¼ unit. Prerequisite: Credit or registration in Chemical Engineering 371. Westwater.

373. Principles of Chemical Engineering. Scientific principles in unit operations of chemical engineering. Lectures, problems, and quizzes. I, II; 1 unit. Prerequisite: Chemical Engineering 371; Chemistry 240. Drickamer.

374. Unit Operations Laboratory. Second course. To accompany Chemical Engineering 373. I, II; ¼ unit. Prerequisite: Credit or registration in Chemical Engineering 373. Baron, Westwater.

377. Chemical Engineering Technology. Study of industrial chemical processes and principles. II; ½ unit. Prerequisite: Chemistry 240.

379. Chemical Engineering Projects Laboratory. Development of an individual project. I, II; ½ unit. Johnstone.

380. Chemical Engineering Calculations. Numerical and graphical methods for problems in equilibria and kinetics. Lectures and recitations. II; ¾ unit. Prerequisite: Chemistry 344; Chemical Engineering 371. Baron.

381. Chemical Engineering Plant Design. Comprehensive problems. I, II; ½ unit. Prerequisite: Chemical Engineering 373. Drickamer.

382. High Pressure Reactions. Lectures, recitations, and problems. II; ½ unit. Prerequisite: Chemistry 234 and 344. Comings.

383. Applied Electrochemistry. Use of electric current through solutions for carrying out reactions. Lectures. I; ½ unit. Prerequisite: Chemistry 234, 336, and 342. Swann.

384. Power Plant and Boiler Water Problems. I; ½ unit. Straub.

385. Bioengineering. Study of the chemical processes and principles used in the production of foodstuffs, pharmaceuticals, and fine chemicals. Primarily for students in chemical engineering. May be substituted for Chemical Engineering 377 and 374 in the chemical engineering curriculum. Lectures and laboratory. Laboratory may be omitted by graduate students. I; 1 to 1¼ units. Prerequisite: Credit or registration in Chemical Engineering 373. Finn.

386. Bioengineering. Principles of chemical engineering applied to the fermentation and allied industries. May be used as an advanced elective and as a substitute for Chemical Engineering 379 in the chemical engineering curriculum. Lectures and laboratory. II; 1¼ units. Prerequisite: Bacteriology 320, Chemistry 234 and 240, or consent of instructor. Finn.

387. Flow of Fluids. Advanced course. Lectures, recitations, and problems. I; ¾ unit. Prerequisite: Chemical Engineering 371, or equivalent with consent of instructor. Comings.

388. Heat Transmission. Advanced course. Lectures, recitations, and problems. I; ¾ unit. Prerequisite: Chemical Engineering 371, or equivalent with consent of instructor. Comings.

CIVIL ENGINEERING

(Including Sanitary Engineering)

The graduate student in civil engineering generally follows one of three fields, transportation and municipal engineering, hydraulic engineering, or structural engineering, including soil mechanics and foundations. The work leads to the degree of Master of Science in Civil Engineering and to the degree of Doctor of Philosophy in Engineering. A prerequisite for graduate work in civil engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in the branch of the subject in which registration is desired.

The work in sanitary engineering leads to the degree of Master of Science in Sanitary Engineering and to the degree of Doctor of Philosophy in Engineering. The prerequisite for admission to the first year of graduate study is a degree of Bachelor of Science in Sanitary Engineering, or the satisfactory completion of the sanitary option in a course in civil engineering, including basic courses in bacteriology, quantitative chemical analysis, and organic chemistry, or their equivalent in the fields of chemistry and biology.

In order to be admitted to graduate work in civil engineering or sanitary engineering, a student must have an undergraduate grade-point average of at least 3.75 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students will not be admitted on limited status.

Because of the wide range of interests in graduate work in the Department of Civil Engineering, there are no specific course prerequisites for a major in the department. The requirements for a major or a minor are subject to the review of and must be approved by the Head of the Department.

A pamphlet describing the opportunities for graduate work and research in the Department of Civil Engineering is available upon request to the Head of the Department.

Assistantships

A number of research graduate assistantships are available in the Department. Appointments are for a term of one or two years. Assistants receive a stipend

and are exempt from the payment of tuition fees. The stipend is $1,200 for the academic year, covering approximately one-half time devoted to research duties in the Engineering Experiment Station and the remainder to graduate study.

Appointments to research graduate assistantships are made only to men with outstanding records or other excellent qualifications. Appointments are given both to first and to second-year graduate students, but only rarely to third-year students who have not previously studied at Illinois. In general, a half-time assistant will require two academic years of residence to obtain the master's degree.

Application blanks for research graduate assistantships are available upon request to the Head of the Department. Applications must be made before March 15 of each year for awards for the year beginning in September.

Graduate Teaching Faculty

Professors: W. C. Huntington (Head of Department), H. E. Babbitt, J. G. Clark, J. S. Crandell, J. J. Doland, N. M. Newmark, W. A. Oliver, R. B. Peck, W. H. Rayner, T. C. Shedd, J. Vawter, C. C. Wiley, W. M. Wilson (Emeritus).

Associate Professors: E. E. Bauer, E. Danner, G. H. Dell, J. C. Dietz, W. W. Hay, F. A. Reickert, H. C. Roberts, C. P. Siess.

Assistant Professor: T. H. Thornburn.

Lecturer: K. Terzaghi.

Courses for Graduates

420. Highway Engineering. Highway construction, street layouts, regional plans, and pavements for cities. I; 1 unit. Prerequisite: Civil Engineering 220. Crandell.

422. Municipal Engineering. City finances and budgets, work of the city engineer, city manager, zoning, playgrounds and parks, street cleaning, smoke prevention, fire prevention. II; 1 unit. Prerequisite: Civil Engineering 220. Crandell.

423. Highway Traffic, Transport, and Safety. Traffic growth, characteristics, surveys, regulations, and signaling; private and commercial transportation by automobile, bus, and truck; transport organization and regulation; accident surveys, analysis, and prevention. I, II; 1 unit. Prerequisite: Civil Engineering 223, or equivalent. Wiley.

424. Airport Design. Selection of site, soil investigation, layout, drainage, runway design and construction, hangars and other structures, and other civil engineering features of airport design and construction. I, II; 1 unit. Prerequisite: Graduate standing in civil engineering. Reickert.

425. Railway Location and Operation. Railway location; track capacity; tonnage ratings; train scheduling. I; 1 unit. Prerequisite: Civil Engineering 203, 226, or equivalent experience, or consent of instructor. Hay.

426. Railway Location and Operation. Continuation of Civil Engineering 425. Additional problems in railway location and maintenance; design of yards, turnouts, and passenger stations; economics of maintenance; railway labor. II; 1 unit. Prerequisite: Civil Engineering 425, or equivalent, or consent of instructor. Hay.

440. Water Supply. Design, pumping machinery, administration, and operation. I; 1 unit. Prerequisite: Bachelor of Science degree in sanitary engineering, or equivalent. Babbitt.

443. Sewerage. Sewer design, construction, maintenance, operation, and financing. II; 1 unit. Prerequisite: Bachelor of Science degree in sanitary engineering, or equivalent. Babbitt.

444. Sewage Disposal, Wastes Disposal, and General Sanitation. Principles and design of sewage treatment and waste disposal works. II; 1 unit. Prerequisite: Bachelor of Science degree in sanitary engineering, or equivalent. Babbitt.

446. Water Purification and General Sanitation. Design of water purification works and principles of sanitation. I; 1 unit. Prerequisite: Bachelor of Science degree in sanitary engineering, or equivalent. Babbitt.

448. Sanitary Engineering. Laboratory. Tests of water supply; sewerage; water purification and sewage treatment equipment and processes. I, II; 1 to 2 units. Babbitt.

450. Hydrology and Flood Control. Magnitude and frequency of flood flow of streams, minimum flow of streams, and regulation of flow by storage reservoirs; intense rainfall and the development of intensity curves for use in rational run-off formula; unit-graph method of computing flood run-off; flood control and prevention by channel improvement, levees, and reservoirs. I, II; 1 unit. Prerequisite: Civil Engineering 250 and 351, or equivalent. Doland.

452. Water Resources Planning and Development. Purposes and technics of planning water resources developments; methods of evaluating the engineering and economic aspects of water conservation projects developed through the examination of actual proposals. II; 1 unit. Prerequisite: Bachelor of Science degree in civil engineering or consent of instructor. Doland.

455. Water Power Engineering. Preliminary investigations, selection of site, storage requirements, structures, machinery, etc. I, II; 1 unit. Prerequisite: Civil Engineering 255, or equivalent. Doland.

457. Hydraulic Engineering Laboratory. Design, construction, and testing of individual or semi-individual laboratory studies. Study and discussion of advanced subjects of hydraulic engineering phenomena. I; 1 to 2 units. Prerequisite: Bachelor of Science degree in civil engineering, or consent of instructor. Doland.

458. Advanced Open Channel Flow. Special transitions, structures, and analysis of existing methods of computation. Theory of supercritical velocity flow. II; 1 unit. Prerequisite: Bachelor of Science degree in civil engineering, or consent of instructor. Doland.

460. Structural Analysis. Basic theory of indeterminate structures; deflections and displacements; continuous beams and frames; virtual work; qualitative and quantitative influence lines. I, II; 1 unit. Prerequisite: Bachelor of Science degree in engineering and undergraduate course in theory of simple structures. Vawter.

461. Structural Theory and Design. General theory of continuity; moment distribution; the column analogy; rigid frame bridges and buildings; fixed and continuous arches; classification of structures from viewpoint of design. I, II; 1 to 2 units. Prerequisite: Bachelor of Science degree in civil engineering with a basic course in indeterminate structures. Shedd, Vawter.

462. Structural Theory and Design. Statically indeterminate trusses; continuous trusses; steel arches; secondary stresses; suspension bridges; long-span roofs; skeleton steel buildings. I, II; 1 to 2 units. Prerequisite: Bachelor of Science degree in civil engineering with a fundamental course in indeterminate structures. Shedd, Vawter.

464. Reinforced Concrete Design. Theories of action of beams, slabs, and columns of rein concrete; codes and specifications and their influence on design; effect of continuity. I, II; 1 unit. Prerequisite: Bachelor of Science degree in engineering with undergraduate courses in structures. Shedd.

465. Steel Design. Design of steel members; codes and specifications for buildings; riveted and welded connections; evolution of bridge specifications; loads and working stresses; economic proportions. I, II; 1 unit. Prerequisite: Bachelor of Science degree in engineering with undergraduate courses in structures. Shedd.

466. Investigations in Reinforced Concrete Members. Behavior of reinforced concrete structural members. Critical reviews of experimental and analytical investigations. Beams and columns, subjected to flexure, axial compression, combined axial compression and flexure, and combined flexure and shear. I; 1 unit. Prerequisite: Bachelor of Science degree in civil engineering with undergraduate courses in structures and reinforced concrete design. Siess.

467. Investigations in Reinforced Concrete Structures. Behavior of reinforced concrete structures. Critical reviews of experimental and analytical investigations. Statically indeterminate reinforced concrete structures: frames, floor slabs, column footings, highway bridge floors. II; 1 unit. Prerequisite: Civil Engineering 466, or consent of instructor. Siess.

469. Wood Structures. Theory and practice in the design of modern wood structures; the effect of the plant origin and physical structure of wood on its mechanical strength; fasteners and their significance in design and the development of design formulae. I, II; 1 unit. Oliver.

470. Earth Pressures and Retaining Walls. A study of earth pressures considering the significant properties of soils; methods of computing earth pressures and the limitations in their dependability; stability computations; and the design and construction of retaining walls and abutments. I; 1 unit. Prerequisite: Bachelor of Science degree in civil engineering. Huntington.

471. Earth and Masonry Dams. Stability of rolled-fill and hydraulic-fill earth dams and rock-filled dams; methods of construction; seepage losses; control of seepage forces; safety of foundations. Solid gravity, arched gravity, arch, multiple arch and slab and buttress dams; safety against sliding and overturning; unit stresses on horizontal sections and principal stresses; joints; drainage; foundations. II; 1 unit. Huntington, Peck.

473. Soil Mechanics. Physical properties of soils; identification and description of soils; permeability, compressibility, consolidation, and shearing resistance; deformation and drainage characteristics. Theories of soil mechanics; earth pressure, stability, settlement, seepage, and consolidation. I; 1 unit. Peck.

474. Soil Mechanics. Practical considerations, boring, sampling, testing; retaining walls, open cuts, slides, dams, and embankments; foundations, settlements due to excavation and other causes; field observations. Limitations and alternatives to conventional procedures of design and construction. II; 1 unit. Prerequisite: Civil Engineering 473. Peck.

481. Numerical and Approximate Methods of Structural Analysis. Methods of successive approximations, and numerical procedures, for the solution of complex problems, with applications to bridges, buildings, and aircraft structures. Method of successive relaxation of constraints, energy methods, difference equations, numerical integration procedures, method of collocation,

method of least squares, and Galerkin's method. I or II; 1 to 2 units. NEWMARK.

482. BUCKLING, VIBRATIONS, AND IMPACT. Elastic and inelastic instability of bars, plates, and plates with stiffeners; vibrations of structures including earthquake effects; action of simple structural elements and of more complex structures subjected to dynamic loads, with applications to bridges, buildings, and aircraft structures. I or II; 1 to 2 units. NEWMARK.

483. ANALYSIS AND DESIGN OF PLATES AND SLABS. Fundamental theory of bending and buckling of plates, including stiffened plates; practical application of theories in analysis and design of reinforced concrete bridge and building floors, highway and airport pavements, and structural plate components in metal. I; 1 to 2 units. Prerequisite: Consent of instructor. NEWMARK.

484. BEHAVIOR OF STRUCTURES UNDER DYNAMIC LOADS. Analysis of the effects of wind load, earth tremors, impact, and explosion blast on buildings and bridges; vibrations of and impacts on structural components, with particular emphasis on beams, slabs, and columns; propagation of stress waves in steel and concrete; effects of damping and inelastic action; self-excited vibrations with application to cables and suspension bridges. II; 1 unit. Prerequisite: Civil Engineering 461, or equivalent. NEWMARK.

485. ANALYTICAL STUDY OF TESTS OF STRUCTURAL MEMBERS. Planning tests, limitations of experimental methods, interpretation of results in terms of design practice. II; 1 unit. WILSON.

486. DESIGN OF LIGHTWEIGHT STRUCTURES. Analysis and design of structures and structural members of minimum weight. I, II; 1 to 2 units. Prerequisite: Bachelor of Science degree with previous work in statically indeterminate structures. CLARK.

491. THESIS (M.S. and Ph.D.) I, II; ½ to 4 units.

493. SPECIAL PROBLEMS. Individual investigations or studies of any phase of civil engineering selected by the student. I, II; ½ to 2 units.

Courses for Graduates and Advanced Undergraduates

332. ENGINEERING PROPERTIES OF SOILS. Laboratory practice in the testing, classification, and identification of soils; engineering soil surveys and explorations; and sampling. I; ½ unit. Prerequisite: Consent of instructor. BAUER.

344. WATER AND SEWAGE TREATMENT. Principles, design, and operation of water purification and sewage treatment works. I; 1 unit. Prerequisite: Credit or registration in Bacteriology 104 and Civil Engineering 240 or 241.

345. PUBLIC HEALTH ENGINEERING. Principles of sanitation, waste collections, and disposal; sanitary regulations, biostatistics. II; ½ unit. Prerequisite: Credit or registration in Bacteriology 104 and Chemistry 122.

351. DRAINAGE AND FLOOD CONTROL. Land drainage, river improvement, flood control. II; ½ unit. Prerequisite: Civil Engineering 250.

356. HYDRAULIC ENGINEERING LABORATORY. Fundamental principles, operation and use of model laboratories, dimensional analysis, hydraulic similitude, theory and design of hydraulic models. II; ¾ unit. Prerequisite: Theoretical and Applied Mechanics 232 and 234. DOLAND.

359. RIVER HYDRAULICS. Gaging of streams, stream erosion and deposition, use of groins, revetments and mats, stream systems, and river navigation. I; ¾ unit. Prerequisite: Theoretical and Applied Mechanics 232. DOLAND.

361. Statically Indeterminate Structures. Elastic theory and its applications to statically indeterminate structures. I, II; ½ unit. Prerequisite: Civil Engineering 262; credit or registration in Civil Engineering 264.

362. Statically Indeterminate Structures. I, II; ½ unit. Prerequisite: Civil Engineering 361, or 262 and consent of instructor.

373. Introduction to Soil Mechanics. Investigation of engineering characteristics of subsurface conditions; principal theories of soil mechanics; application to design of retaining walls, open cuts, drainage systems, and stability of slopes. I; 1 unit. Prerequisite: Credit or registration in Civil Engineering 270, or consent of instructor. Peck.

374. Applied Soil Mechanics. Application of soil mechanics to foundations of buildings, compaction of embankments, and construction of culverts and tunnels. II; 1 unit. Prerequisite: Credit or registration in Civil Engineering 270, or consent of instructor. Peck.

375. Engineering Aspects of Surficial Soils. Use of geologic, pedologic, and airphoto information for identification and evaluation of the engineering properties of surficial soils. II; 1 unit. Prerequisite: Civil Engineering 230, or consent of instructor. Thornburn.

THE CLASSICS

The Department of Classics offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy.

The degree of Master of Arts may be taken in Latin, in Greek, in the Classics, or in the Teaching of Latin. For the degree of Master of Arts in the Classics, the major may be either Latin or Greek, with the other language offered as a minor.

The Degree of Doctor of Philosophy is given in Classical Philology. Major work may be taken in either Latin or Greek, but whichever language is taken as a major, the other one must be taken either as the sole minor or as a first minor.

Students applying for admission must have a 3.5 grade-point average for that portion of the work which represents the last fifty per cent of the hours earned toward the bachelor's degree, exclusive of required courses in physical education and military training. Students on limited status will not be admitted.

All graduate students should take the course in Bibliography and Criticism, Greek (or Latin) 495-496, during their first year of graduate study. Other regulations of the department governing graduate studies are described in a mimeographed bulletin which may be obtained by applying to the Head of the Department.

Graduate Teaching Faculty

Professors: J. L. Heller (Head of Department), B. E. Perry (on leave second semester 1950-1951), A. Turyn.

Associate Professor: R. P. Oliver.

Assistant Professor: L. D. Johnston.

Instructor: F. D. Lazenby.

GREEK

Preparation for first-year graduate work in Greek should include at least three years of college Greek, or equivalent, and two years of college Latin. A reading knowledge of German and French is important for candidates in this subject. The study of history and philosophy is especially recommended.

Courses for Graduates

411. Theocritus. Theocritus and the Alexandrian Age. I; 1 unit. Prerequisite: Three years of college Greek. Offered in 1951-1952 and every third year thereafter. Perry.

412. Lucian and His Age. II; 1 unit. Prerequisite: Three years of college Greek. Offered in 1951-1952 and every third year thereafter. Perry.

413. Greek Lyric Poetry. Reading of a wide selection of Greek lyrics of the classical period, with a study of representative genres and poets, including, among others, Sappho, Alcaeus, Pindar, and Bacchylides. I; 1 unit. Offered in 1952-1953 and every third year thereafter. Turyn.

414. Greek Drama: Tragedy. II; 1 unit. Prerequisite: Adequate knowledge of Greek. Offered in 1952-1953 and every third year thereafter. Perry.

415. Homer. I; 1 unit. Prerequisite: Adequate knowledge of Greek. Offered in 1950-1951 and every third year thereafter. Turyn.

416. Thucydides. II; 1 unit. Prerequisite: Three years of college Greek, or consent of instructor. Offered in 1950-1951 and every third year thereafter. Heller.

421. Aristotle. Reading and analysis of the *Politics*; its place in Greek thought. I; 1 unit. Prerequisite: Reading knowledge of Greek or graduate major in either political science or philosophy. Offered in 1951-1952 and every third year thereafter. Turyn.

422. Plato. II; 1 unit. Prerequisite: Adequate knowledge of Greek. Offered in 1951-1952 and every third year thereafter. Turyn.

424. Greek Drama: Comedy. II; 1 unit. Prerequisite: Adequate knowledge of Greek. Offered in 1952-1953 and every third year thereafter. Perry.

426. Homer (continued). I; 1 unit. Prerequisite: Adequate knowledge of Greek. Offered in 1950-1951 and every third year thereafter. Heller.

491. Research in Special Topics. Same as Latin 491. Guidance in writing theses for advanced degrees. I; 1 unit. Heller, Oliver, Perry, Turyn.

492. Research in Special Topics. Same as Latin 492. Guidance in writing theses for advanced degrees. II; 1 unit. Heller, Oliver, Perry, Turyn.

495. Bibliography and Criticism. Same as Latin 495. Introduction to the methods and techniques of scholarship. I; ½ unit. Prerequisite: Three years of college Latin, or equivalent. Oliver.

496. Bibliography and Criticism. Same as Latin 496. II; ½ unit. Prerequisite: Three years of college Latin, or equivalent. Oliver.

Courses for Graduates and Advanced Undergraduates

301. Herodotus and the Lyric Poets. I; ½ unit. Prerequisite: Greek 202, or equivalent. Offered in 1950-1951 and in alternate years. Turyn.

302. Thucydides and Plato. II; ½ unit. Prerequisite: Greek 301, or 303, or equivalent. Offered in 1950-1951 and in alternate years. Turyn.

303. Greek Drama. I; ½ unit. Prerequisite: Greek 202, or equivalent. Offered in 1951-1952 and in alternate years. Lazenby.

304. Oratory and Aristotle. II; ½ unit. Prerequisite: Greek 301, or 303, or equivalent. Offered in 1951-1952 and in alternate years. Lazenby.

318. Classical Archaeology. A survey of the art, public and private antiquities, and monuments of the ancient world. I; ½ unit. Lazenby.

LATIN

Preparation for first-year graduate work in Latin should include at least two years of preparatory Latin and three years of college Latin. A reading knowledge of French and German is important. Some acquaintance with Greek is highly desirable, and the study of history and philosophy is especially recommended.

Candidates for the degree of Master of Arts in the Teaching of Latin must earn four units in Latin, two units in education, and two units in electives. At least two of the four required units in Latin must be in courses numbered above 400; the other two units may be chosen in whole or in part from the following list: Latin 301, 302, 305, and 306. The required work in education consists of Education 311 and 312 and one unit selected from Education 301, 302, 303, 304. The electives may be in Latin, in Greek, in education, or, in exceptional cases, in other fields. The courses in Latin and the electives must be selected with the approval of the adviser, Professor J. L. Heller, 126 Lincoln Hall.

Courses for Graduates

409. History of the Latin Language. I; 1 unit. Prerequisite: Three years of college Latin, or equivalent. Offered in 1951-1952 and in alternate years. Heller.

411. Latin Epigraphy. A study of inscriptions as documents illustrating the evolution of the Latin language, and as records of the customs, beliefs, and ideals of the common people of Rome and the provinces. I; 1 unit. Prerequisite: Three years of college Latin, or equivalent. Offered in 1951-1952 and every third year thereafter. Oliver.

412. Latin Elegy. II; 1 unit. Prerequisite: Three years of college Latin, or equivalent. Offered in 1951-1952 and every third year thereafter. Oliver.

413. Caesar. I; 1 unit. Prerequisite: Adequate knowledge of Latin. Offered in 1952-1953 and every third year thereafter. Turyn.

414. Lucan. II; 1 unit. Prerequisite: Adequate knowledge of Latin. Offered in 1952-1953 and every third year thereafter. Oliver.

415. Lucretius. A study of the text, the meaning, and the sources of the *De Rerum Natura*. I; 1 unit. Prerequisite: Three years of college Latin, or equivalent. Offered in 1950-1951 and every third year thereafter. Perry.

416. Vergil. II; 1 unit. Prerequisite: Adequate knowledge of Latin. Offered in 1950-1951 and every third year thereafter. Turyn.

421. Horace. I; 1 unit. Prerequisite: Adequate knowledge of Latin. Offered in 1951-1952 and every third year thereafter. Turyn.

422. Terence. II; 1 unit. Prerequisite: Adequate knowledge of Latin. Offered in 1951-1952 and every third year thereafter. Turyn.

423. Latin Romance. I; 1 unit. Prerequisite: Three years of college Latin, or equivalent. Offered in 1952-1953 and every third year thereafter. Perry.

424. Cicero's Letters. II; 1 unit. Prerequisite: Adequate knowledge of Latin. Offered in 1952-1953 and every third year thereafter. Turyn.

425. The Philosophy of Cicero. A study of the political, ethical, and religious thought expressed in the *De republica, De officiis,* and other philosophic

works. I; 1 unit. Prerequisite: Adequate knowledge of Latin. Offered in 1950-1951 and every third year thereafter. TURYN.

426. TACITUS. The *Annales*. II; 1 unit. Prerequisite: Three years of college Latin, or equivalent. Offered in 1950-1951 and every third year thereafter. OLIVER.

431. ROMAN ORATORY. S; 1 unit. Prerequisite: Adequate knowledge of Latin. TURYN.

491. RESEARCH IN SPECIAL TOPICS. Same as Greek 491. Guidance in writing theses for advanced degrees. I; 1 unit. HELLER, OLIVER, PERRY, TURYN.

492. RESEARCH IN SPECIAL TOPICS. Same as Greek 492. Guidance in writing theses for advanced degrees. II; 1 unit. HELLER, OLIVER, PERRY, TURYN.

495. BIBLIOGRAPHY AND CRITICISM. Same as Greek 495. Introduction to the methods and techniques of scholarship. I; ½ unit. Prerequisite: Three years of college Latin, or equivalent. OLIVER.

496. BIBLIOGRAPHY AND CRITICISM. Same as Greek 496. II; ½ unit. Prerequisite: Three years of college Latin, or equivalent. OLIVER.

Courses for Graduates and Advanced Undergraduates

301. LIVY AND TACITUS. I; ½ unit. Prerequisite: Twelve hours of Latin acceptable for a major. Offered in 1951-1952 and in alternate years. OLIVER.

302. HORACE. II; ½ unit. Prerequisite: Twelve hours of Latin acceptable for a major. Offered in 1951-1952 and in alternate years. OLIVER.

303. CICERO. I; ½ unit. Prerequisite: Twelve hours of Latin acceptable for a major. Offered in 1950-1951 and in alternate years. OLIVER.

304. VERGIL. II; ½ unit. Prerequisite: Twelve hours of Latin acceptable for a major. Offered in 1950-1951 and in alternate years. OLIVER.

311. ADVANCED LATIN COMPOSITION. Practice in the writing of Latin prose. Required of those receiving recommendations of the department as teachers. I; ½ unit. Prerequisite: Twelve hours of Latin acceptable for a major. TURYN.

312. ADVANCED LATIN COMPOSITION. Practice in the writing of Latin prose. II; ½ unit. Prerequisite: Latin 311. TURYN.

MASS COMMUNICATIONS

The University of Illinois admits each year a few qualified students to a program of graduate study in mass communications leading to the degree of Doctor of Philosophy. This doctoral program is administered by an interdepartmental committee, and the program itself is designed interdepartmentally to apply the methods and disciplines of the social sciences (supported where necessary by the arts and natural sciences) to the basic problems of human communication.

The program is intended for students whose academic and professional experience qualifies them to study mass communications, and whose plans for careers are such as to make this interdepartmental degree more desirable than a degree in one of the social sciences. Among such careers may be the teaching of journalism, radio, or other communication subjects, research in the fields of public opinion or audience study, and executive jobs in the communication industries requiring breadth, perspective, and a scientific background.

Prerequisites to admission to this program are at least one course in each of

the following subjects: psychology, sociology, political science, economics, and statistics. If a student lacks one of these prerequisites, he may be admitted probationally while he makes up the deficiency, but he may not count that course among the twenty-four units required for the degree.

A candidate for this degree is expected to meet the following requirements:

(1) A total of twenty-four units of graduate work, among them

(a) Four or more units of graduate courses in mass communications, such as 390, 391, 426, 444, 462, 471, 474, 475, 481 below.

(b) One or more units in research methods or field studies, such as 366, 367, 441, 482 below.

(c) Two minors in social sciences or, in special cases, in other areas approved by the administrative committee. A minor is here defined as three or more graduate units.

(d) Electives as needed to make twenty-four units and as approved by the administrative committee. These electives are often used to broaden the background in social science, to strengthen the minors, or, especially in the case of a candidate preparing for experimental work, to add more work in statistics and higher mathematics.

(2) Reading knowledge of two modern foreign languages, preferably French, German, or Russian.

(3) A written examination covering the broad field of communication. The candidate is eligible to take this examination when he has earned sixteen units and has passed his foreign language examinations.

(4) A satisfactory dissertation on some topic in mass communications.

(5) A final examination centered on, but not restricted to, the field of the dissertation.

A candidate for the degree of Doctor of Philosophy who wishes to minor in mass communications should select four, three, or two courses (according to the requirements of his major department) from the following list. Such a candidate is expected to have a social science background sufficient for such courses as he chooses. If he has any doubt as to the adequacy of his background, he should consult the chairman of the administrative committee who will also advise him as to desirable combinations and sequences of courses.

Graduate Teaching Faculty

Professors: F. S. Siebert (Chairman of Administrative Committee), J. W. Albig, G. Fairbanks, W. G. Madow, C. H. Sandage, W. Schramm, D. W. Smythe.

Associate Professors: E. T. Curry, T. W. Harrell, R. B. Hudson, C. E. Osgood.

Assistant Professor: G. J. Wischner.

Courses for Graduates

426. Experimental Psychology of the Communication Process. Same as Psychology 426. A critical survey of methods and theories in the psychological study of the communication process, with the emphasis upon the development of symbolic behavior, experimental semantics, and frequency studies; application will be made to various problems in social science. II; 1 unit. Prerequisite: One year of graduate study; consent of instructor. Osgood.

441. Measurement of Opinion and Attitude. Same as Journalism 441 and

Psychology 441. Theory and practice in measurement of opinion and attitude formation and change. Attitude scales; factors affecting morale; interpretation of results from social and psychological characteristics of the population; intensity of attitudes; relations among attitudes and opinions. I or II; 1 unit. Prerequisite: Psychology 100; a course in statistics; a course in sociology, social psychology, advertising, or market research. HARRELL.

444. SEMINAR IN PUBLIC OPINION. Same as Sociology 444. I, II; 1 unit. ALBIG.

462. SEMINAR IN RADIO AND TELEVISION. Same as Journalism 462. A study of the performance of radio and television in terms of content, government and industry controls, social responsibility, economic bases, and psychological and social effects. II; 1 unit. HUDSON.

471. THEORY OF COMMUNICATIONS. Same as Journalism 471. Nature of the communication process; development of communication patterns and institutions; principles governing the control and support of mass communications; content and audience study; effects of communication; and relation of mass communications to public opinion and group action. I; 1 unit. SCHRAMM.

473. GOVERNMENT AND MASS COMMUNICATIONS, I. Same as Journalism 473. Historical background and philosophical bases of freedom of the press. I; 1 unit. SIEBERT.

474. GOVERNMENT AND MASS COMMUNICATIONS, II. Same as Journalism 474. Current legal, constitutional, and administrative problems of media of mass communications; contemporary issues resulting from the restrictive, regulatory, and supplementary activities of government in the field of mass communications. II; 1 unit. SIEBERT.

481. ADVANCED ADVERTISING PRINCIPLES. Same as Marketing 481 and Journalism 481. Emphasis is placed on determination and understanding of the principles as related to the science, philosophy, and art of advertising. I; 1 unit. SANDAGE.

482. RESEARCH METHODS IN ADVERTISING AND COMMUNICATIONS. Same as Marketing 482 and Journalism 482. A critical study of research methods and their applications to the solution of advertising problems. II; 1 unit. SANDAGE.

491. RESEARCH IN SPECIAL TOPICS (THESIS). I; 1 to 4 units. Prerequisite: Consent of chairman and thesis supervisor. STAFF.

492. RESEARCH IN SPECIAL TOPICS (THESIS). II; 1 to 4 units. Prerequisite: Consent of chairman and thesis supervisor. STAFF.

Courses for Graduates and Advanced Undergraduates

366. THEORY OF SAMPLE SURVEYS. Same as Mathematics 366. The development of the formulae to be used in the efficient planning of sample surveys and the interpretation of the results. I or II; 1 unit. Prerequisite: Calculus or Mathematics 112 and a first course in statistics. MADOW.

367. PRACTICE OF SAMPLE SURVEYS. Same as Mathematics 367. Training in planning and making sample surveys. How the results are interpreted. One or more sample surveys will be planned in detail. I or II; 1 unit. Prerequisite: Calculus or Mathematics 112 and a first course in statistics. MADOW.

390. ECONOMICS OF COMMUNICATIONS, I. Same as Economics 390. Economic problems associated with the various forms of radio broadcasting including FM, television, and facsimile, and the use of radio for the safety and

efficiency of transportation, protective services, etc. I, II; ½ to 1 unit. Prerequisite: Economics 102, 103, or 108. SMYTHE.

391. ECONOMICS OF COMMUNICATIONS, II. Same as Economics 391. Economic problems associated with the following means of communications: motion pictures, newspapers, magazines, and books. II; ½ to 1 unit. Prerequisite: Economics 102, 103, or 108. SMYTHE.

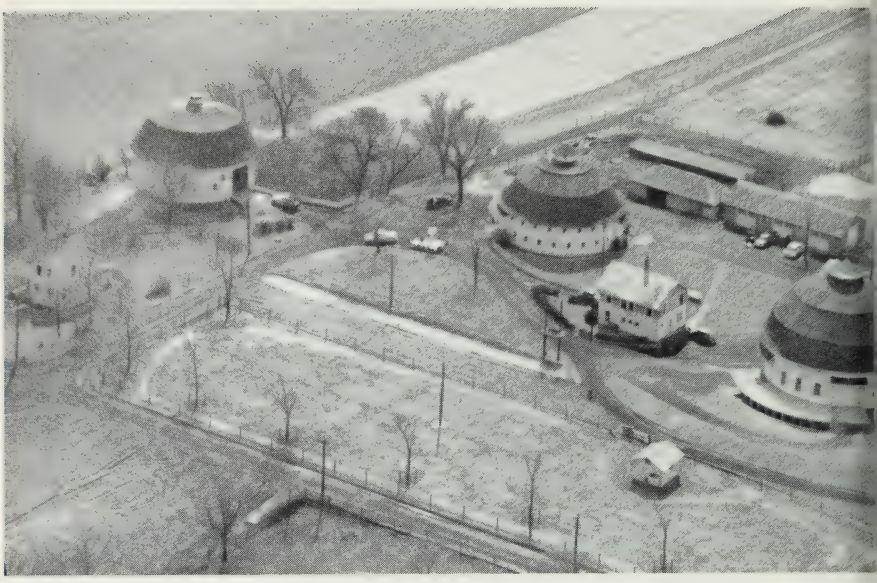
DAIRY SCIENCE

The Department of Dairy Science offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy. This work is given in three divisions: dairy bacteriology, dairy biochemistry, and dairy production, including dairy cattle genetics, physiology, nutrition, management, and milk production, each calling for a somewhat different undergraduate preparation and graduate program. Students majoring in dairy science may select one of these areas of study for the master's or doctor's degree. Students interested in the economics of milk production normally will major in the Department of Agricultural Economics. For the Master of Science degree, students may elect to confine their work entirely to the major. If a minor is chosen, it must be in another department. For the Doctor of Philosophy degree, students may select a sole minor in another department, or a first minor and a second minor, the first of which may be in a field closely allied to the area of specialization of the major; the second must be taken in another department. The amount of graduate credit required in each case is dependent upon the specifications of the Graduate College and the department in which the minor is chosen. Students selecting dairy bacteriology or dairy biochemistry as areas of specialization for the major in dairy science should expect and be prepared to elect some branch of chemistry as one of the minors for an advanced degree.

An applicant's undergraduate grade-point average must be at least 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Limited status students will be accepted. The undergraduate preparation necessary consists of basic training in the biological and natural sciences, especially chemistry, physiology, zoology, genetics, mathematics, and elementary courses in agronomy, animal nutrition, bacteriology, dairying, and economics. Students without the necessary training and background may register for graduate work in the Department, but will be required to spend part of their time in residence to remove the deficiency.

For a major in dairy science for either advanced degree, students must select, with the advice of the Head of the Department, a faculty adviser in the separate area of study desired. The adviser will specify course requirements including possible deficiencies to be removed for the degree sought and their sequence, and will direct the research and the preparation of the thesis. Candidates for the degree of Master of Science must complete one-half unit of Dairy Science 490, and two units of Dairy Science 493 or 494. For the degree of Doctor of Philosophy, one and eight units, respectively, of these courses must be completed. Other course requirements depend upon the separate area of study in which the student specializes and upon his background training. Information concerning such requirements may be obtained from the departmental office, 120 Davenport Hall. Attention is directed to the fact that each student should have acquired proficiency in one language before starting graduate work (see language requirements for the Doctor of Philosophy degree listed on page 21).

Candidates for the degree of Master of Science are expected to complete an acceptable thesis unless conditions warrant waiver of this requirement which may



Round Barns in Use on a Farm Run by the Department of Dairy Science

be done only upon petition to and permission of the Dean of the Graduate College. All students expecting to continue graduate studies should fulfill the thesis requirement. A comprehensive examination concerning the thesis and the general field of dairy science is a departmental requirement for the degree of Master of Science.

In addition to the general requirements of the Graduate College with respect to residence credit, language proficiencies, thesis, and preliminary and final examinations, candidates for the degree of Doctor of Philosophy when starting the second year of graduate study will meet with a departmental committee of Graduate College faculty which will determine the areas in which the student requires special training and will recommend to the student's major adviser his future course of study.

For a minor in dairy science, students should select a minor adviser in the area of study of their choice and determine with that adviser the specific courses required. For the degree of Master of Science, the minimum requirements are: for a first minor, two units in dairy science; for a second minor, one unit in dairy science.

For the degree of Doctor of Philosophy, the minimum requirements are: for a sole minor, four to six units of dairy science of which three units must be in 400 numbered courses; for a first minor, four units in dairy science; and for a second minor, two units in dairy science.

Assistantships

Teaching and research assistantships are available each year to candidates for either advanced degree. Most of these assistantships are on a half-time basis and involve a reduced study schedule as outlined in the general regulations of the Graduate College. Inquiries and applications should be addressed directly to the Head of the Department.

Graduate Teaching Faculty

Professors: G. W. Salisbury (Head of Department), R. W. Bartlett, W. B. Nevens, H. A. Ruehe, W. W. Yapp.

Associate Professors: K. E. Gardner, R. G. Hansen.

Assistant Professors: R. L. Hays, W. O. Nelson, N. L. Vandemark, W. A. Wood.

Courses for Graduates

405. Economic Milk Production. II; 1 to 2 units. Yapp.

408. Physiology of Lactation. II; ½ to 2 units. Hays.

450. Dairy Bacteriology. Assigned laboratory problems in dairy bacteriology. I, II; ½ to 2 units. Prerequisite: Dairy Science 150, 151, and 350. Nelson, Wood.

453. Dairy Bacteriology Seminar. Review of current literature in dairy bacteriology, and discussion of current problems. II; ½ unit. Nelson, Wood.

480. Dairy Chemistry. Assigned problems. I, II; ½ to 2 units. Hansen.

490. Dairy Science Seminar. Current literature relating to various phases and areas of dairy science. I, II; ½ unit. Salisbury.

493. Research. Work may be taken in the following subjects: dairy bacteriology, dairy chemistry, dairy cattle breeding and genetics, dairy cattle feeding, dairy cattle physiology, milk production. Graduate students writing a thesis should so indicate when registering. I; 1 to 4 units. Gardner,

Hansen, Hays, Nelson, Nevens, Ruehe, Salisbury, Vandemark, Wood, Yapp.

494. Research. Work may be taken in the following subjects: dairy bacteriology, dairy chemistry, dairy cattle breeding and genetics, dairy cattle feeding, dairy cattle physiology, milk production. Graduate students writing a thesis should so indicate when registering. II; 1 to 4 units. Gardner, Hansen, Hays, Nelson, Nevens, Ruehe, Salisbury, Vandemark, Wood, Yapp.

Courses for Graduates and Advanced Undergraduates

311. Problems in Dairy Farming. Dairy farm operation, including field and building arrangement, cropping systems, herd management, sanitary milk production, and farm marketing problems. Lectures, quiz, assigned readings, and problems. I; ¾ unit. Prerequisite: Dairy Science 100 and 202. Yapp.

320. Special Problems. I, II; 1 unit. Prerequisite: Senior standing; approval of head of department. Gardner, Hansen, Hays, Nelson, Nevens, Salisbury, Vandemark, Wood, Yapp.

330. Reproduction and Artificial Insemination of Farm Animals. The anatomy and physiology of reproduction in farm animals, the principles of artificial insemination, and the factors affecting conception in natural and artificial breeding. I; ¾ unit. Prerequisite: Zoology 104 and either Dairy Science 100 or Animal Science 100. Vandemark.

334. Marketing Dairy Products. Same as Agricultural Economics 334 and Marketing 334. The dairy industry in our national economy; factors affecting per capita consumption; price plans and policies; expanding markets; trade associations and labor unions; looking ahead in the milk business. Inspection trip; estimated expense, $5. II; ½ unit. Prerequisite: Agricultural Economics 130, or Marketing 101, or twelve hours of dairy science or dairy technology. Bartlett.

350. Advanced Dairy Bacteriology. Bacteriology of dairy products — normal and abnormal. I; 1 unit. Prerequisite: Bacteriology 104 and 105. Nelson, Wood.

380. Composition of Dairy Products. I; ¾ unit. Prerequisite: Chemistry 132. Hansen.

ECONOMICS

The Department of Economics offers graduate work leading to the degrees of Master of Arts, Master of Science, and Doctor of Philosophy.

An applicant's undergraduate grade-point average must be at least 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students on limited status will not be admitted.

Students who wish to make economics their major subject for an advanced degree must have had at least twenty-seven hours of undergraduate work in social science, fifteen of which must have been in economics; the work in economics must include a course in principles of economics, a course in statistics, and other courses for which the course in principles is a prerequisite. Students in other departments who wish to take a minor in economics must have had at least twelve hours in social sciences, eight hours of which must have been in economics, consisting of a

course in principles of economics and other courses for which the course in principles is a prerequisite. Students who can not meet these requirements may register for graduate work but, unless specifically exempted because of superior scholarship or for other reasons satisfactory to the adviser in charge, must remove any deficiencies during the first year of residence by taking prescribed courses without graduate credit.

A first-year student whose major is economics must take either Economics 400-401 or 402-403. If a minor is taken outside the Department, two units of work will ordinarily be required. Undergraduate courses that are approved for graduate credit may be taken in lieu of graduate courses but not to exceed a total credit of two units.

A student who wishes to become a candidate for the Doctor of Philosophy degree with a major in economics must pass a preliminary examination showing: (1) a detailed knowledge of economic theory and its history; (2) a detailed knowledge of certain special fields of economics or allied fields, the number and selection of which is to be determined by the adviser in consultation with the student; and (3) a general acquaintance with the subject matter and bibliography of other branches of economics. In the work offered in some related field outside the Department the student will be expected to satisfy the examiners as to his proficiency in that subject.

A student who chooses economics as a minor for the Doctor of Philosophy degree must take at least two units of work in this Department.

Assistantships

The Department of Economics awards for each academic year a limited number of assistantships to graduate students in economics. These ordinarily provide a stipend of $1,200 plus tuition for half-time teaching or research, or $600 plus tuition for quarter-time service. Under general policy of the Department these assistantships are awarded only to those who have their master's degrees or the equivalent. In exceptional cases, however, particularly where the scholastic records are outstanding, quarter-time, or even half-time, assistantships are granted persons with no graduate training.

Prospective graduate students in economics who seek assistantships in the Department should submit applications not later than March 1 preceding the academic year for which appointment is sought. Requests for application forms and for any additional information regarding these assistantships should be addressed to the Chairman of the Department of Economics, University of Illinois, Urbana, Illinois.

Graduate Teaching Faculty

Professors: E. E. Hagen (Chairman of Department), H. K. Allen, V L. Bassie, J. F. Bell (on leave second semester 1950-1951), H. R. Bowen, Dorothy S. Brady, P. H. Brown, W. E. Chalmers, H. M. Gray, L. Hurwicz, D. L. Kemmerer, D. P. Locklin, E. B. McNatt, W. H. McPherson, W. A. Neiswanger, Margaret G. Reid, D. W. Smythe, P. M. Van Arsdell, E. T. Weiler.

Associate Professors: J. F. Due, D. P. Flanders, R. W. Harbeson, F. B. Haworth, G. Kleiner, R. W. Mayer, J. L. McConnell, R. I. Mehr, F. Modigliani, R. M. Nolen, D. W. Paden, J. B. Parrish, G. A. Steiner, W. C. Robb.

Assistant Professor: Grace Beckett.

Courses for Graduates

400. General Economic Theory. A preliminary survey of business, labor, government, monetary, and other institutional aspects of economics, followed by a more extended analysis of theoretical economics and the application of this theory to some of the problems raised in the preliminary survey. Intended for students whose minor is economics and other students who have only the minimum preparation for graduate study in economics. I; 1 unit. Prerequisite: Economics 102 and 103, or 108. Flanders.

401. General Economic Theory. A preliminary survey of business, labor, government, monetary, and other institutional aspects of economics, followed by a more extended analysis of theoretical economics and the application of this theory to some of the problems raised in the preliminary survey. Intended for students whose minor is economics and other students who have only the minimum preparation for graduate study in economics. II; 1 unit. Prerequisite: Economics 102 and 103, or 108. Flanders.

402. Economic Theory. The principles of economics, with special emphasis on value and distribution, for students whose major is economics and others who have had a thorough training in economics. I; 1 unit. Prerequisite: At least twenty-seven hours of undergraduate work in social sciences, fifteen of which must have been in economics; the work in economics must include a course in the principles of economics, a course in statistics, and other courses for which the course in principles is a prerequisite.

403. Economic Theory. The principles of economics, with special emphasis on value and distribution, for students whose major is economics and others who have had a thorough training in economics. II; 1 unit. Prerequisite: At least twenty-seven hours of undergraduate work in social sciences, fifteen of which must have been in economics; the work in economics must include a course in the principles of economics, a course in statistics, and other courses for which the course in principles is a prerequisite.

404. Economic Fluctuations and Stabilization Policies. An examination of business cycle theory (as distinct from general employment theory) and of alternative proposals for economic stabilization through governmental fiscal, monetary, and other operations. I; 1 unit. Prerequisite: Economics 303, 422, or consent of instructor. Hagen.

405. Seminar in National Income and Employment Theory. A study of the more complex and comprehensive attempts to construct economic models explaining the determinants of the level of employment, and of their use in policy formation. Individual research projects of a statistical or purely theoretical nature. II; 1 unit. Prerequisite: A course in employment theory. Hagen.

406. A History of Economic Thought. Development of economic thought from early times to the present. I; 1 unit. Bell.

407. History of Economic Thought. Development of economic thought from early times to the present. II; 1 unit. Bell.

408. Mathematical Introduction to Macro-Economics. Systematic treatment (with the help of appropriate mathematical tools) of the equilibrium level and fluctuations of the major economic variables. II; 1 unit. Prerequisite: Mathematics 142 or 147, Economics 303, or consent of instructor. Hurwicz.

410. Comparative Economic Systems. The economics of capitalism, socialism, communism, and fascism. I; 1 unit.

412. Advanced Topics in Micro-Economics. Selected topics in the theory of behavior of the basic economic units — household and firm — treated with the help of mathematical tools. I; 1 unit. Prerequisite: Mathematics 142 or 147, Economics 403, or consent of instructor. Modigliani.

414. Public Finance. A critical study of the application of economic principles to public expenditures, revenues, borrowing, and administration of funds. I; 1 unit. Prerequisite: Six hours of economics. Allen, Due.

415. Public Finance. A critical study of the application of economic principles to public expenditures, revenues, borrowing, and administration of public funds. II; 1 unit. Prerequisite: Six hours of economics. Allen, Due.

418. Contemporary Economic Problems and Literature. This course gives the student an opportunity to read critically some of the books which are significant in contemporary economic literature but which he has not read in other courses. S; ½ unit. Brown.

420. Monetary Theory and History. A study of the development of money and monetary theory to 1914: Greece and Rome, Bank of England, classical monetary theory, early United States, national banking system, and gold standard. I; 1 unit. Nolen.

421. Monetary Theory and History. A study of the development of money and monetary theory since 1914: central banking theory and practice, World War I finance, gold standard and depreciation of currencies, public spending, and contemporary theory and practice. II; 1 unit. Nolen.

422. Theory of Aggregate Income. Not open to those who have received credit in Economics 303. A comprehensive introduction to the theory of the determinants of the level of aggregate income. I, II; 1 unit. Prerequisite: Economics 251, or consent of instructor. Hagen.

426. Theories and Policies of International Commerce. Development of the theory of international trade; commercial policies. I; 1 unit. Beckett.

427. Theories and Policies of International Trade. Problems in international trade. II; 1 unit. Beckett.

428. International Economics and Finance. Analysis of international monetary standards; of their effects on domestic income levels, finance, and central bank problems. I; 1 unit. Prerequisite: Preparation in economics. Kleiner.

429. International Economics and Finance. Governmental policies designed to maximize domestic welfare through international exchange of goods and services and through international investment. II; 1 unit. Kleiner.

436. Economic History of the United States. Colonization, westward movement, agriculture, transportation, industrial revolution, trust movement, slavery, labor conditions and organizations, capital growth, money and banking, commerce, and social progress. Material to 1860. I; 1 unit. Kemmerer.

437. Economic History of the United States. Colonization, westward movement, agriculture, transportation, industrial revolution, trust movement, slavery, labor conditions and organizations, capital growth, money and banking, commerce, and social progress. Material since 1860. II; 1 unit. Kemmerer.

440. Labor Economics. Same as Labor and Industrial Relations 440. A critical economic analysis of contemporary English and American wage theory, employment and unemployment, and collective bargaining, with emphasis on public policy. I; 1 unit. Prerequisite: Six hours of economics. McNatt.

441. Labor Economics. Same as Labor and Industrial Relations 441. A critical economic analysis of contemporary English and American wage theory, employment and unemployment, and collective bargaining, with emphasis on public policy. II; 1 unit. Prerequisite: Six hours of economics. McNatt.

442. Problems and Practices in Collective Bargaining. Same as Labor and Industrial Relations 442. Seminar in the methods and techniques of collective bargaining in the negotiation of the labor contract; nature and significance of labor agreements; union, management, and public interests in major contract provisions. I; 1 unit. Prerequisite: Consent of instructor. McPherson.

443. Problems and Practices of Labor Dispute Settlement. Same as Labor and Industrial Relations 443. Seminar in the techniques of labor contract administration; comparative study of grievance procedure operation; analysis of conciliation, fact-finding, and arbitration procedures, including case studies of arbitration awards. II; 1 unit. Prerequisite: Consent of instructor. McPherson.

446. Trade Unions and the Economy. Same as Labor and Industrial Relations 446. The economic significance of trade unionism: the role of unions as economic policy making institutions; basic economic criteria in union-management negotiations; union policies and changing technology; unions and social security issues; effect of trade union policies and practices on the functioning of a competitive system. I; 1 unit. Prerequisite: Six hours of economics. Parrish.

447. Labor Union Organization and Administration. Same as Labor and Industrial Relations 447. Analysis of the structure and government of the modern American trade union movement with particular reference to the relation between organization and function. Problems relating to the function and execution of economic policies, the maintenance of unity and discipline, the adjustment of jurisdictional conflicts, and the observance of agreements will be examined and appraised. II; 1 unit. Prerequisite: Major in social sciences, or consent of instructor. Chalmers.

454. Corporation Finance. Nature of corporation finance and its relation to economics, accounting, and law; development of business corporation; concepts of capital, capitalization, and capital stock; nature of equities in corporation; financial analysis and interpretation; nature and development of financial plans; corporate securities and their adaptation to financial plan; initial and promotional financing; current capital financing; income administration; refinancing. I; 1 unit. Prerequisite: Economics 254. Van Arsdell.

455. Corporation Finance. Expansion; consolidation, concentration, and intercorporate relations; the corporate institution and the problem of monopoly and competition; corporate failure and reorganization; corporate financial management and the economy. II; 1 unit. Prerequisite: Economics 254. Van Arsdell.

456. Investments. The theory and practice of investment; the return on invested capital; the classification and use of investment securities; governmental agencies for the protection of the investor. I; 1 unit. Brown.

457. Investments. Procedures to determine the investment value of corporate securities; business conditions and security price movements; the selection of securities for a portfolio, the problems presented in determining the value of a business enterprise. II; 1 unit. Prerequisite: Economics 456, or equivalent. Brown.

460. Economics of Risk and Insurance. A study of the nature and cost of risk in our economic society and of the methods of handling it. I; 1 unit. Mehr.

461. Economics of Risk and Insurance. A study of the nature and cost of risk in our economic society and of the methods of handling it. II; 1 unit. Mehr.

470. Economic Statistics. Analysis of frequency distributions and patterns of economic behavior. The problem of statistical induction and economic data. The construction and interpretation of index numbers. I; 1 unit. Prerequisite: At least one course in the principles of economics and one in statistical methods. Neiswanger.

471. Economic Statistics. Methods of analysis, economic time series; measurement and interpretation of functions in economic data. II; 1 unit. Prerequisite: At least one course in the principles of economics and one in statistical methods. Neiswanger.

472. Econometrics. Same as Mathematics 472. Application of the principles of mathematical statistics to estimation of economic relationships. II; 1 unit. Prerequisite: Credit or registration in Mathematics 364. Hurwicz.

473. Economic Forecasting. Forecasting techniques; analysis of important forecasting situations in terms of strategic forces and relationships; the place of judgment in evaluating current information, selecting critical factors, and appraising the validity of analytical techniques. II; 1 unit. Prerequisite: One year of statistics. Bassie.

480. Seminar in the Relations of Government and Business. Problems in the relations of government and business. Discussions and individual research in selected problems of economic policy arising from the inter-relations of government and business. I; 1 unit. Gray.

481. Seminar in the Relations of Government and Business. Problems in the relations of government and business. Discussions and individual research in selected problems of economic policy arising from the inter-relations of government and business. II; 1 unit. Gray.

484. Economics of Transportation. A study of the principal economic problems arising in connection with the development and regulation of railroads and other modes of transport. I; 1 unit. Locklin.

485. Economics of Transportation. A study of the principal economic problems arising in connection with the development and regulations of railroads and other modes of transport. II; 1 unit. Locklin.

488. Government Regulation of Economic Activity. A critical economic appraisal of the objectives and results of government policy and practice in controlling economic activity. I, II; 1 unit. Steiner.

490. Individual Study and Research. Directed reading and research. I, II; ½ to 1 unit. Hagen and others.

491. Seminar (A.M. and Ph.D.). Required of all students writing master's and doctor's theses in economics. I; 1 to 4 units. Master's theses, Flanders. Doctor's theses, Hagen.

492. Seminar (A.M. and Ph.D.). Required of all students writing master's and doctor's theses in economics. II; 1 to 4 units. Master's theses, Flanders. Doctor's theses, Hagen.

Courses for Graduates and Advanced Undergraduates

303. Theory of Employment and the Price Level. A brief introduction to national income concepts, neoclassical theory of forces determining the level

of output; presentation and critique of quantity of money theory of price level; presentation and critique of neo-Keynesian theory of price level, output, and employment; reconciliation of these theories. S; ½ to 1 unit. Prerequisite: Economics 250, or consent of instructor. HAGEN.

306. HISTORY OF ECONOMIC THOUGHT. A study of the development of economics. Contributions of schools of thought and individual writers are examined as they influenced economic thought and national policy. I, II; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108. BELL.

312. ECONOMICS OF WELFARE. An analysis and summary of the consequences for human welfare of economic security, political and economic freedom, consumption standards, community of enterprise, ratio of population to resources, unemployment, inequality of distribution, human costs in production, etc. Utilitarianism, Germanic theories of the state, and other systems of thought relating to welfare will be examined. II; ½ to 1 unit. Prerequisite: Economics 102 or 108. MCCONNELL.

315. PROBLEMS IN FEDERAL TAXATION. An intensive study of the present federal tax system, with particular reference to inequities and effects of the taxes upon the economy; alternative measures of reform. II; ½ to 1 unit. Prerequisite: Economics 214. DUE.

326. FOREIGN COMMERCE AND COMMERCIAL POLICIES. International trade relationships; changes in theories and policies. I; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108. BECKETT.

328. LATIN AMERICAN ECONOMIC PROBLEMS. Economic problems of commerce, finance, transportation, mining, agriculture, and industry in Latin America; Latin American and international economic relationships. II; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108. BECKETT.

336. AMERICAN ECONOMIC HISTORY. Westward movement; growth of industry, agriculture, commerce, finance, transportation, trust movement, and labor. Not open to students who took Economics 336 (formerly Economics 22) as freshmen. I, II; ½ to 1 unit. KEMMERER.

342. ECONOMICS OF SOCIAL SECURITY. Same as Labor and Industrial Relations 342. A critical analysis of the economic issues and problems involved in our legislative efforts to reduce the economic risks of unemployment, old age dependency, and industrial injury. I; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108. MCNATT.

343. THE LABOR MARKET. Same as Labor and Industrial Relations 343. Economic analysis of the labor market, its structure, characteristics, and operations in contrast with other markets; factors making for equilibrium and disequilibrium; migration; occupational and industrial mobility; labor market research including techniques and materials. II; ½ to 1 unit. Prerequisite: Economics 102 or 108, and 240. PARRISH.

344. THE LAW AND LABOR. Same as Labor and Industrial Relations 344. An economic analysis of the problems and issues arising out of the legislative and judicial efforts to define the rights, duties, and responsibilities of labor organizations and management in the field of industrial relations. II; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108; Economics 240. MCNATT.

346. FOREIGN LABOR MOVEMENTS. Same as Labor and Industrial Relations 346. Analysis of the history, organization, economic policies, political programs, and domestic, international, and contemporary influence of the labor movements of Great Britain, Sweden, Germany, France, Latin America, and Russia. I; ½ to 1 unit. Prerequisite: Economics 240. CHALMERS.

363. Advanced Life Insurance. A study of the application of life insurance to the problems of family security, business security, investments, and estate protection. II; ½ to 1 unit. Prerequisite: Economics 262. Mehr.

366. Casualty Insurance. An examination of hazards, contracts, forms, rates, underwriting principles, and loss prevention activities in the following branches of insurance: workmen's compensation, automobile, public liability, burglary, robbery, theft, glass, power plant, credit, accident and health, and fidelity and surety. I; ½ to 1 unit. Prerequisite: Economics 260. Mehr.

371. Applied Problems in Sampling. Design of various types of samples useful in economic and business research. Cost limitations and the design of samples. Sources of bias and sampling methods. Interpretation of the results. I, II; ½ unit. Prerequisite: One course in mathematics; Economics 170, or a similar introductory course in statistics. Brady.

372. Index Numbers. The theoretical formulation of index numbers and the statistical problems of estimation and measurement for index numbers of price, production, productivity, cost of living, level of living, and preference scales. II; ¼ unit. Prerequisite: Economics 170; Economics 102 and 103, or 108. Brady.

373. Correlations in Business and Economic Data. A study of the measurement of relationships among economic and business data. Methods for expressing these relationships (correlation, analysis of variance, chi-square) will be studied by examining specific problems in which these techniques have proved to be useful. The use of critical attitudes in the use of statistical tools will be emphasized throughout the course. II; ½ unit. Prerequisite: Economics 170, 171, or Economics 271, or equivalent. Paden.

375. The National Income and Its Distribution. Concepts of national income and of related measures of income and output. The statistical aspects of estimating the national income and its distribution and of analyzing the interrelationships in national income and related series. I; ½ unit. Prerequisite: Economics 170. Brady.

378. Consumers and the Market. Market forces affecting the quantity, quality, and price of consumer goods and consumers' ability to choose wisely, with special attention to retailing, monopolistic competition, advertising, the provision of information to consumer and important controls relating to these. II; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108. Reid.

379. Consumer Economics. National and family consumption and factors affecting these, such as income, price, type of community, family size and type; uses of consumption data by various groups, for example, in market, wage, tax, social security, and various other policies. I, II; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108; Economics 170. Reid.

380. Economic Problems of the Family. Economic functions and problems of the family, important changes, household production, earning the family income, its adequacy and security, the family standard of living, spending and saving, and problems of financial management. I; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108. Reid.

384. Economics of Transportation. Economic aspects of the transportation industry with special emphasis on problems of regulation and public policy. I, II; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108. Harbeson, Locklin.

385. Economic Problems of Commercial Air Transport. Study of air transport with particular reference to questions of public policy, system of regu-

lation, and regulatory policy. I; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108. LOCKLIN.

389. PUBLIC POLICY RELATING TO COMPETITION AND MONOPOLY. The organization and tactics of market control, the development of antitrust law and policy, public policy regarding competitive practices, special policies applying to natural resource industries, and regulated monopoly and government ownership as alternatives to the antitrust approach. I; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108. HARBESON.

390. ECONOMICS OF COMMUNICATIONS, I. Same as Communications 390. Economic problems associated with the various forms of radio broadcasting including FM, television, and facsimile, and the use of radio for the safety and efficiency of transportation, protective services, etc. I, II; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108. SMYTHE.

391. ECONOMICS OF COMMUNICATIONS, II. Same as Communications 391. Economic problems associated with the following means of communications: motion pictures, newspapers, magazines, and books. II; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108. SMYTHE.

EDUCATION

The graduate student who majors in Education may specialize in administration and supervision, agricultural education, curriculum, educational psychology, elementary school teaching, guidance and personnel work, history and philosophy of education, home economics education, industrial education, research methods, secondary school teaching, or the education of exceptional children.

The general requirements for all graduate students in education are:

(1) *Admission.* Admission to graduate and professional degree work in education requires a grade-point average of 3.5 or higher for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, excluding required physical education and military training, provided also that the undergraduate preparation is appropriate to advanced study in a chosen major field.

(2) *Grades.* Not more than one unit of work for which a passing grade of less than B is received may be counted toward an advanced degree. A student who receives a passing grade of less than B in more than two units of work or who fails to pass a course will be disqualified from candidacy for a degree.

Degree of Master of Arts or Master of Science in Education. In addition to the general rules of the Graduate College pertaining to admission, registration, programs, degree requirements, grades, residence, majors and minors, foreign language, and theses (see pages 11-20), the following regulations apply to programs leading to the degree of Master of Arts or Master of Science in Education.

(1) A minimum of eight units, including a thesis of two units (Education 491-492) is required.

(2) Extramural course work is not applicable toward these degrees.

(3) Competence in certain fields is required of all students. Competence may be demonstrated by a grade of B or better in the required courses or by satisfactory completion of a proficiency examination in those courses. Education 311 and 312 are required. Two courses chosen from Education 301, 302, 303, and 304 are required.

These degrees are usually the first step toward the degree of Doctor of Philosophy in Education. They will also satisfy, in part, the requirements for admission to candidacy for the degree of Doctor of Education.

Degree of Master of Science in the Education of the Deaf. For admission to the curriculum for the degree of Master of Science in the Education of the Deaf, one of the following prerequisites is necessary: (1) a bachelor's degree in elementary or special education (other than the deaf), or (2) a bachelor's degree in education of the deaf from an accredited training center for teachers of the deaf.

Candidates for the degree must earn a minimum of eight units as follows:

(1) Education 311 and 312 are required. Two courses chosen from Education 301, 302, 303, and 304 are required.

(2) For those students qualifying under prerequisite (1), Education 317, one-half unit; Education 319, one or one and one-half units; Education 320, one to two units; Speech 301, one-half unit; Speech 395, one-half unit; and Speech 385, one-half unit, are required. For those students qualifying under prerequisite (2), Education 418, one unit, and Education 449, one unit, are required.

(3) Electives should be chosen from the following: Speech 375, 388, 488, 489; Psychology 412, 465; Education 381, 412, 425, 426, 427, 430, 438, 439, 440, 456, 460; Home Economics 201 and 202.

The adviser for candidates for this degree is Professor S. A. Kirk, 309 Gregory Hall.

Degree of Master of Science in the Education of Mentally Handicapped Children. For admission to the curriculum for the degree of Master of Science in the Education of the Mentally Handicapped Children, the following prerequisites are necessary: Courses sufficient to meet the requirements for an Illinois Teacher's Certificate, and the following undergraduate courses: Education 231, Education 220 (Section A), and Speech 208.

Candidates for the degree must earn a minimum of eight units as follows:

(1) Required courses: Education 311, one-half unit; Education 312, one-half unit; two courses chosen from Education 301, 302, 303, and 304; Education 317, one-half unit; Education 322, one-half unit; Education 323, one-half unit; Education 426, one unit.

(2) Elective courses are to be chosen from the following list: Education 390, 411, 412, 417, 433; Psychology 338, 404, 406, 412, 436, 471, 493, 494; Speech 385, 388.

The adviser for candidates for this degree is Professor S. A. Kirk, 309 Gregory Hall.

Degree of Doctor of Philosophy. For general requirements for the degree of Doctor of Philosophy, see page 20. A student who wishes to become a candidate for the degree of Doctor of Philosophy with a major in Education must have met (a) the academic requirements for the degree of Master of Arts or Master of Science in Education, and (b) have written a thesis. Applicants for admission should present credentials well in advance of the date for their first registration. Planning a program of study requires that any necessary examinations and other steps preliminary to admission be completed prior to the registration period. Admission is not complete until the student is accepted by an adviser.

Professional Degrees

These degrees are designed for teachers, supervisors, administrative officers, and others engaged in educational work demanding broad, fundamental, and practical preparation and the ability to utilize professionally the contributions of research and philosophy.

Master of Education. The degree of Master of Education partially fulfills the requirements for admission to candidacy for the Advanced Certificate in Education, or the degree of Doctor of Education.

(1) *Admission.* In addition to general requirements, the work presented for admission must include a minimum of sixteen semester hours in Education with a grade-point average of 3.5 for all education courses.

(2) *Residence.* At least four units must be earned in residence. Residence is defined as attendance at the University of Illinois for one semester during which a minimum of three units is satisfactorily completed, or in a summer session during which a minimum of one and one-half units is satisfactorily completed. If the student is regularly employed for twelve months each year, he must be in residence for four summer sessions during each of which one unit of work is completed.

Students holding academic appointments of more than one-half time while taking graduate courses are regarded as being in residence, even though they are not conforming to the above regulation.

(3) *Program.* A minimum of eight units of graduate work is required. Four units must be earned in the field of education. The general requirements of the Graduate College governing minor fields apply to this degree.

No more than four units of credit earned through any combination of (a) examination for credit in graduate work completed elsewhere, (b) extramural course work, and (c) nonresident campus registration, may be applied toward the degree.

Secondary school teachers who, at the time of first registration, do not hold from the state in which they are employed a certificate valid for every subject which they are teaching will be required to take sufficient courses in the respective subject matter fields to meet the requirements for a valid certificate. With the prior approval of an adviser, courses in subject matter fields which carry two hundred numbers may be approved for advanced professional credit. Such credit will be computed at the rate of one quarter unit for each semester hour of credit. The total credit allowed for such courses will not exceed two units. No such credit can be counted toward the requirements of the degrees of Master of Arts, Master of Science, Doctor of Education, and Doctor of Philosophy.

In general, candidates for the degree of Master of Education are expected to take at least two units in fields other than education. This provision is especially applicable to students in secondary education.

Competence in certain fields is required of all students. Competence may be demonstrated by a grade of B or better in required courses or by satisfactory completion of proficiency examinations in those courses. Education 311 and 312 are required. Two courses chosen from Education 301, 302, 303, and 304 are required.

Advanced Certificate in Education. The program leading to the Certificate is designed to provide advanced training to increase the competence of professional workers and not to prepare students for further graduate study. Students who become candidates for the Certificate will not be considered as beginning work leading to the degrees of Doctor of Education or Doctor of Philosophy.

(1) *Admission.* A candidate for admission must hold a master's degree from an accredited institution. He must have satisfactorily completed at least two years of professional employment in education.

(2) *Residence.* The definition of residence given under the description of the Master of Education degree applies to this Certificate.

(3) *Program.* A minimum of eight units of course work beyond the master's degree is required. All course work must be taken on the Urbana Campus of the University. At least four units must be taken in residence. Education 301, 302, 303, 304, 311, 312, 390, 413, and either 411 or 412 are required. Students may meet the requirements in all courses at the three hundred level by achieving a grade of B or better in the courses or by satisfactorily completing proficiency examinations.

Secondary school teachers who, at the time of first registration, do not hold

from the state in which they are employed a certificate valid for every subject which they are teaching will be required to take sufficient courses in the respective subject matter fields to meet the requirements for a valid certificate. With the prior approval of an adviser, courses in subject matter fields which carry two hundred numbers may be approved for advanced professional credit. Such credit will be computed at the rate of one quarter unit for each semester hour of credit. The total credit allowed for such courses will not exceed two units. No such credit can be counted toward the requirements of the degrees of Master of Arts, Master of Science, Doctor of Education, and Doctor of Philosophy.

Doctor of Education. Programs leading to the degree of Doctor of Education are designed to provide advanced professional training and develop further ability in the scholarly study of professional problems.

(1) *Admission.* A candidate for admission must hold a master's degree from an accredited institution. Admission will be determined by examination, personal interviews, record of previous education and experience, and recommendation from persons who have known the candidate.

Applicants for admission should present credentials well in advance of the date for their first registration. Planning a program of study requires that any necessary examinations and other steps preliminary to admission be completed prior to the registration period. Admission is not complete until the student is accepted by an adviser.

(2) *Residence.* Minimum residence requirements are (a) two consecutive semesters during each of which a minimum of three units of work is successfully completed, or (b) one semester during which a minimum of three units is successfully completed and the summer session immediately preceding or following during which a minimum of one and one-half units is successfully completed, plus an additional summer session during which a minimum of one and one-half units is successfully completed.

(3) *Program.* A minimum of sixteen units of course work beyond requirements for the Master's degree is required. Extramural course work may not be included as part of this sixteen unit requirement. An adviser may recommend that a student transfer from the Doctor of Education program to the program for the Advanced Certificate in Education any time prior to the completion of five units.

A student who has completed course work beyond the master's degree at the University of Illinois or at another accredited institution, may petition for the application of not more than six units of such work toward the program leading to the degree of Doctor of Education. A student may, with the approval of his adviser, plan a maximum of four units of work to be accomplished at other accredited institutions. No more than six units of credit earned at other universities may be included in the minimum of sixteen unit requirements.

Education 410, 415, and 496 are required.

A preliminary examination must be completed satisfactorily prior to the beginning of the dissertation. A student who has completed a minimum of eight units of course work subsequent to his admission may take the preliminary examination when it is recommended by his adviser. The preliminary examination is given by a committee appointed by the Dean of the Graduate College. The nature of the examination will be determined by the committee. Part of the examination may be written. Part of it must be oral.

Prior to admission to the preliminary examination, the student is expected to demonstrate competence in the psychology of learning, psychology of adolescence or child growth and development, psychology of adjustment or mental hygiene and the school, social psychology, social foundations of education, philosophy of education, history of American education, and comparative education. Competence may be demonstrated by a grade of B or better in an appropriate course or by satisfactory completion of a proficiency examination. The thesis required for the

degree of Doctor of Education may be in the area of improving professional practice and may be a field study. No academic credit is granted for the thesis. General regulations of the Graduate College covering the filing of thesis title and the preparation, submission, and publication of theses must be met.

A final oral examination is held at least two weeks prior to the date the degree is conferred. The examination committee is appointed by the Dean of the Graduate College. The final examination is primarily concerned with the report of the thesis study, but also extends over the whole field of the candidate's study. It is designed to determine whether or not the candidate has a thorough and mature understanding of the field of education as a whole.

Graduate Teaching Faculty

Professors: W. B. Spalding (Dean of the College of Education), K. D. Benne, T. E. Benner, G. M. Blair, R. B. Browne, R. W. Burnett, F. G. Cornell, L. J. Cronbach, J. J. DeBoer, G. P. Deyoe, E. W. Dolch, F. H. Finch, C. R. Griffith, H. M. Hamlin, H. C. Hand, W. V. Kaulfers, S. A. Kirk, A. B. Mays, P. V. Miller, C. W. Odell, E. F. Potthoff, E. H. Reeder, C. W. Sanford, J. H. Shores, R. H. Simpson, B. O. Smith, W. Van Til, Letitia Walsh.

Associate Professors: A. W. Anderson, J. T. Hastings, K. B. Henderson, C. G. Knapp, W. P. McLure, H. A. Schultz, Celia B. Stendler, M. R. Sumption, J. L. Trump.

Assistant Professors: R. G. Brill, N. L. Gage, W. E. Harnish, W. E. Martin, Liesette J. McHarry, F. McMurray, G. W. Reagan, W. O. Stanley, E. M. Woodman.

Courses for Graduates

400. Ancient and Medieval Education. A study of educational thought and practice in early Mediterranean civilizations, in ancient Greece and Rome, and in the Middle Ages. Emphasis is placed on the relation of education to the intellectual and social conditions of the several periods covered. I; 1 unit. Offered in 1950-1951 and in alternate years. Prerequisite: Education 300, or consent of instructor. Anderson.

401. Modern Theories of Education. A critical analysis and examination of the theories of education represented by the work of Robert M. Hutchins, Henry C. Morrison, the Harvard Committee, and William H. Kilpatrick. II; 1 unit. Stanley.

402. Educational Movements in the Twentieth Century. A historical study of the more significant educational trends during the past fifty years with special reference to their influence on the problems of American education. An analytical examination of the principal transition movements in the last decade of the nineteenth century and an examination of the efforts to solve the problems since 1900. I; 1 unit. Prerequisite: Education 300, or 302, or 403, or consent of instructor. Anderson.

403. The Historical Foundations of American Educational Thought. A study of the evolution of education theories and philosophies since the eighteenth century, with particular reference to their impact upon educational developments in the United States. Effort will be made to give broad view of the general growth of American educational thought, with sufficient time devoted to selected major educational theorists, or schools of thought, to permit adequate exploration of their fundamental ideas and the relation of

these ideas to significant intellectual currents in American culture. II; 1 unit. Prerequisite: Education 300 or 302, or consent of instructor. ANDERSON.

404. SEMINAR IN EDUCATIONAL CLASSICS. Reading and group discussion of a limited number of the most important writings in educational philosophy which have had a profound influence on the progress of educational thought and practice. II; 1 unit. Prerequisite: One graduate course in philosophy of education and one in history of education, or consent of instructor. BENNE.

405. FOUNDATIONS OF GROUP METHOD. A critical study of the ethical, social-psychological, and methodological ideas and problems underlying currently proposed methods for the management and improvement of groups and for training leadership in using these methods, with special attention to the use of such methods in educational settings. The work includes student projects in the management and improvement of educational and action groups. I; 1 unit. Prerequisite: Education 311 and 312; any two of the following: Education 301, 302, 303, 304. BENNE, MILLER.

406. SEMINAR IN THE HISTORY OF EDUCATION. Intensive group study of a small number of selected problems to assist individual students to develop understanding of and the ability to use the techniques of historical research in furthering such study. Problems to be studied in any one semester are selected in the light of the interests and previous training of the group of students enrolled. II; 1 unit. Offered in 1951-1952 and in alternate years. Prerequisite: Two courses in the history of education and one course in the philosophy of education, or consent of instructor. ANDERSON.

407. LOGICAL FOUNDATIONS OF METHODS. A study of the application of principles of logic in methods of instruction. This study involves the treatment of the problems of educational direction and control in processes of inference, judgment, and knowing, examined from the standpoint of recent developments in pragmatism. II; 1 unit. Prerequisite: Consent of instructor. MCMURRAY.

408. ADVANCED PHILOSOPHY OF EDUCATION. A rigorous examination of the foundations of educational theory as they relate to the major educational issues of our time. This examination requires a careful analysis of the pertinent works of John Dewey, as well as the more significant current philosophical viewpoints opposed to Dewey's outlook. I; 1 unit. Prerequisite: Advanced graduate standing; consent of instructor. BENNE, MCMURRAY, STANLEY.

409. ADVANCED PHILOSOPHY OF EDUCATION. Continuation of Education 408. II; 1 unit. Prerequisite: Education 408. BENNE, MCMURRAY, STANLEY.

410. SEMINAR IN THEORIES OF EDUCATIONAL AND SOCIAL CHANGE. Designed to help prospective educational leaders acquire an understanding of current theories of social change as these relate to the work of the profession of teaching. There is now an extensive body of knowledge on the nature and control of social change. This needs to be made available to all prospective educational leaders in order that they may go about their duties with greater understanding and skill. Designed to aid students in bringing this knowledge to bear upon the problems of leadership in educational and social change. I; 1 unit. Open only to advanced degree candidates. BENNE, SMITH, STANLEY.

411. PSYCHOLOGY OF ADOLESCENCE FOR TEACHERS. The psychological significance of adolescence, its biological and social foundation, and its implications for education. I, II; 1 unit. Prerequisite: Education 311 and 312. BLAIR.

412. Advanced Child Development for Students of Education. A consideration of the nature of the child and his development during the pre-school and elementary school years, with emphasis on development as a process of social learning. An interpretation of the scientific literature as it concerns the educative process. Discussion of methods of studying and evaluating the behavior of the child as an individual and in group situations. I; 1 unit. Prerequisite: Education 311 and 312. Martin.

413. Social Psychology and the Problems of Education. A consideration of the concepts and methods of social psychology as they apply to the professional functions of teachers, administrators, and other persons engaged in education. Opportunity to work upon field problems is provided. II; 1 unit. Prerequisite: Education 311 and 312. Gage.

415. Education and the Individual. An advanced course in human behavior required of all candidates for the degree of Doctor of Education. Special attention is given to contemporary systems of psychology and their relationship to educational practice. I, II; 1 unit. Prerequisite: Education 311 and 312; Education 411 or 412; candidacy for Ed.D. or Ph.D. in Education. Blair.

416. Problems in Mental Deficiency. An advanced course in mental deficiency, covering definitions, theories, classifications, etiology, diagnosis, and social, medical, psychological, and educational rehabilitation procedures. The emphasis of the course is on the contributions of biology, sociology, anthropology, and psychology to educational theory and practice with reference to the mentally deficient. I; 1 unit. Prerequisite: Education 317 and 322, 323, or consent of instructor. Kirk.

417. Administration and Supervision of Education of Exceptional Children. A course for elementary school supervisors, principals, and superintendents and for supervisors of special education classes. Study of the research dealing with physical, mental, emotional, and social traits of all types of exceptional children. Discussion of the special school provisions needed for their education and development. Includes an analysis of the methods of selection of children for special training, buildings and equipment needed by teachers for each type, state laws pertaining to exceptional children, finance and administration. S; 1 unit. Kirk.

418. Problems in Communication for the Deaf. An advanced course in the problems of communications used by the deaf, including the learning of language, reading, speech, and speech reading. Consideration is given to the various methods that are used in the teaching of these basic skills to deaf children and the psychological principles underlying the methods. II; 1 unit. Offered in 1950-1951 and in alternate years. Prerequisite: Education 319 and 320, or equivalent. Brill.

419. Clinical Educational Diagnosis. A clinical course in the diagnosis of educational disabilities, including reading, spelling, and arithmetic. Practice in the use of diagnostic instruments, interpretation of results, and case studies, with recommended remediation, is emphasized. II; 1 unit. Offered in 1951-1952 and in alternate years. Prerequisite: Education 311 and 312; Psychology 465. Kirk, Woodman.

420. The Social Psychology of the Handicapped. A study of the social and emotional adjustment of handicapped children and adults, the effects of different handicaps on adjustment to different situations. The somato-psychological significance of mental, sensory, and motor variations in the adjustive process. The effects of limitations imposed on different groups of handicapped children and adults by the attitude of society, the attitude of

the individual toward his handicap, and the handicap itself are evaluated. The implications of somatopsychological findings and theories for current educational programs for the handicapped are analyzed. II; 1 unit. Prerequisite: Education 312 and 317. KIRK.

422. BASIC PRINCIPLES OF COUNSELING. Study of the counseling processes that are especially applicable to the problems of normal individuals, with particular reference to conditions occurring in elementary and secondary schools. Theories of education and of personality which underlie counseling procedures currently employed in schools, and those proposed for use in school guidance programs are studied for the purpose of developing the student's ability to evaluate these procedures. I, II; 1 unit. Prerequisite: Education 311 and 312. FINCH.

423. THE USE OF TESTS IN GUIDANCE. Deals with purposes of types of tests used in studying guidance problems, the principles underlying the choice, and critical analysis of tests of ability and personality that are useful in this area, and the problems that occur in the collection of test data for school guidance programs. I; 1 unit. CRONBACH.

424. CASE ANALYSIS IN GUIDANCE. The nature, synthesis, and use of case data for guidance purposes. II; 1 unit. Prerequisite: Education 422 and 423.

425. EDUCATIONAL AND VOCATIONAL GUIDANCE. A study of the basic principles of guidance, and the means by which these principles can be applied in dealing with problems of educational and vocational adjustment as they occur in the school. I, II; 1 unit. FINCH.

426. DIAGNOSTIC AND REMEDIAL PROGRAMS OF THE SCHOOL. A study of remedial programs in personality, reading, spelling, English, arithmetic, handwriting, and content subjects. I, II; 1 unit. DOLCH.

428. THE ANALYSIS AND USE OF OCCUPATIONAL INFORMATION IN GUIDANCE PROGRAMS. Deals with the results of recent occupational research, and with the use of these results by teachers and counselors. Attention given to research techniques suitable for use in local occupational studies. II; 1 unit. Prerequisite: Education 425, or consent of instructor. FINCH.

430. ELEMENTARY SCHOOL ORGANIZATION AND ADMINISTRATION. This course is intended primarily for elementary school principals and for those who are preparing for the principalship. Such topics as the following are considered: present status of the elementary school principal; classification and promotion of pupils; school records; report cards; plans for student participation in self-government; and school-community relationships. I; 1 unit. Prerequisite: Education 431 and 439. BARNES.

431. ELEMENTARY SCHOOL CORE PROGRAMS. An exploration of several organizational centers for determining selection and sequence of educative experiences: the social problems approach, the themes approach, the centers of interest approach, and the life situations approach. The role of the teacher in relation to the above considerations is emphasized. I, II; 1 unit. STENDLER.

432. ADVANCED PROBLEMS IN ELEMENTARY SCHOOL TEACHING. A study of and research in the problems of designing and programming experiences for children at the various levels of the elementary school: concentration on the place of skills, group interrelations, social understandings, health problems, creative activities, and the like. Course is based on specific needs and problems of individual students enrolled. I; 1 unit. Prerequisite: Education 431 and 439. SHORES.

433. CURRICULUM PROBLEMS AND TRENDS IN SPECIAL FIELDS OF ELEMENTARY

EDUCATION. A study of the place of the various special fields of elementary education in the emerging elementary school curriculum, with a review and analysis of recent trends and research findings in these fields. Sections will usually be offered in the following fields: (a) reading and the language arts, (b) social studies, (c) elementary science, and (d) arithmetic. I, II; 1 unit. Prerequisite: Education 431. REEDER, SHORES.

436. SOCIAL AND PSYCHOLOGICAL FACTORS IN ELEMENTARY SCHOOL CURRICULUM DEVELOPMENT. Intended to enable curriculum workers to design and to deal effectively with the specific problems involved in changing curriculum structures and content. I; 1 unit. Prerequisite: Education 412, 431, and 439. BARNES, SHORES.

437. METHODS OF CHILD STUDY. A study of ways in which teachers can evaluate child behavior and development. Demonstration, observation, practice. II; 1 unit. Prerequisite: Education 311, 312, and 412. MARTIN.

438. SUPERVISION OF THE ELEMENTARY SCHOOL. Designed for present and prospective supervisors in elementary schools. It considers the purposes of supervision in the context of a democratic theory of teaching and learning. The use of teachers' meetings and of individual supervisory techniques will be given special attention. II; 1 unit. Prerequisite: Education 431 and 439. REEDER.

439. FUNDAMENTALS OF CURRICULUM DEVELOPMENT. Designed to explore and clarify the several theoretical bases offered in educational literature for each of the major aspects of curriculum planning, to indicate the forms implementation of these theories have assumed in practice, to reduce these theoretical and practical differences to fundamental issues, to encourage critical evaluation of both the theories and practices from the standpoint of logical and empirical evidence and to project, on the basis of such analysis, needed research, present best practice, and ultimately desirable programs. I, II; 1 unit. SHORES, SMITH.

440. ADMINISTRATION OF JUNIOR AND SENIOR HIGH SCHOOLS. Discussion of practical problems; functions of the principal; teacher-participation; personnel records, marks, failures, and promotions; administration of the curriculum, of guidance programs, of extracurricular activities, and of housing and building programs. II; 1 unit. TRUMP.

441. SUPERVISION OF JUNIOR AND SENIOR HIGH SCHOOLS. To provide students with experiences in group processes so that they may learn better how to work effectively with individuals and groups. Also aims to provide an understanding of fundamental principles of democratic supervision and the techniques used in achieving desired results. II; 1 unit. Prerequisite: A minimum of one year's teaching experience. TRUMP.

442. JUNIOR COLLEGE. The place of the junior college in the modern program of public education; social, economic, and other changes responsible for development of post-secondary education as found in junior colleges, area vocational schools, and technical institutes. II; 1 unit. CLEVENGER.

444. INSTRUCTIONAL, GUIDANCE, AND EXTRA-CLASS ACTIVITIES PROGRAM IN THE SECONDARY SCHOOL. Designed to give the student a descriptive overview of the present and emerging instructional, guidance, and extra-class activities program of the secondary school; to acquaint him with the principles upon which this program should be based; to help him identify and define the problems, particularly those at the practical level, usually encountered in

making these principles operative; and to evoke his critical appraisal of techniques for resolving these problems. I, II; 1 unit. HAND, HENDERSON.

449. INDEPENDENT STUDY. To offer opportunity and challenge of self-directive, independent study, i.e., to develop the individual's ability as an independent student; to enable the student to pursue needed study in a field in which appropriate courses are not being offered during a given semester. I, II; 1 unit. No more than two units in Education 449 may be offered toward an advanced degree except by special consent of the Dean. STAFF.

450. EVALUATION IN HOME ECONOMICS EDUCATION. Theory and techniques of evaluation in home economics at different educational levels. Analysis and refinement of instruments, interpretation of results for self-evaluation and guidance, and effective administration of programs. Next steps needed for progress in appraisal. II; 1 unit. WALSH.

451. SUPERVISION IN HOME ECONOMICS EDUCATION. The theory, principles, and techniques of pre-service and in-service training of teachers of home economics. Organization, administration, evaluation, and possible future improvement of existing programs. Class visitation and other techniques practiced; supervisory materials prepared. I; 1 unit. WALSH.

453. PROBLEMS IN HOME ECONOMICS EDUCATION. Designed to prepare "consumers of research" through a comprehensive study and evaluation of home economics investigations now available and through the experience of carrying out an individual investigation of limited scope. II; 1 unit. WALSH.

456. CURRICULUM PROBLEMS AND TRENDS IN SPECIALIZED FIELDS OF SECONDARY EDUCATION. Sections will usually be offered in the fields of (a) art education, (b) business education, (c) English, (d) home economics, (e) mathematics, (f) foreign languages, (g) science, (h) social studies, (i) common learnings. Designed to develop an understanding of the function of a specific field of special interest in general education. The course applies principles of curriculum construction to the special field. It introduces the student to significant problems, points of view, and trends in the field concerned. It also acquaints him with significant research relating to organization, content, and techniques in the fields in question. Students are limited to registration in any two sections in addition to the section on common learnings. I, II; 1 unit. Prerequisite: Education 439 and certification requirements for a minor in the specific field (except common learnings). BURNETT, DEBOER, HAND, HENDERSON, KAULFERS, KNAPP, SCHULTZ, VAN TIL, WALSH.

457. SUPERVISION OF STUDENT TEACHING. The organization and operation of student teaching programs. Individual investigation of content, experiences, theory, and practice for those who plan to supervise student teaching activities. I; 1 unit. Offered in 1950-1951 and in alternate years.

459. WORKSHOP IN CURRICULUM DEVELOPMENT. Curriculum development projects in the specialized fields of business, English, home economics, physical education, mathematics, science, social studies, and common learnings education. Broader areas of emphasis, within which students may work, are extra-class activities, conservation, consumer education, family living, guidance, health, inter-group relations, labor-management relations, public opinion and propaganda, and world citizenship. S; 1 to 2 units. STAFF.

460. EDUCATIONAL ADMINISTRATION. Provides the basic common understanding of theory and practice in American educational administration which should

be expected of teachers, supervisors, and administrative officers. Not open to students who have taken any of the following courses: Education 461, 462, 464, 465, 466. I, II; 1 unit. BENNER, CLEVENGER, MILLER.

461. SCHOOL FINANCE. Designed for advanced graduate study of technical problems in school finance. A critical analysis of emerging patterns of financial support in various states, effect of taxation systems on support patterns, emerging controls and structural features as related to finance, the technology of finance distribution patterns for drafting legislation. Review of research on school finance, a critical analysis of theory of school finance, and introduction to techniques of appraising the influence of financial support upon educational returns. I; 1 unit. Prerequisite: Education 460. MCLURE.

462. PUBLIC SCHOOL BUSINESS MANAGEMENT. Designed for advanced graduate study of business management of local school systems. Emphasis is placed upon the process of operation through first-hand acquaintance with budget making and execution; management of internal accounts; development of effective record systems; purchase, distribution, and management of supplies; operation and maintenance of school plants; management of auxiliary services such as transportation, cafeterias, health; and general office management. II and alternate summers; 1 unit. Prerequisite: Education 461. MCLURE, MILLER.

464. CURRENT PROBLEMS IN SCHOOL ADMINISTRATION. Practicum in school administration for administrators in service. The course is designed to give direct help on local problems, to serve as a refresher course, and to bring the administrator up to date on recent developments in school administration. Open only to students currently employed as school administrators. S; 1 to 2 units. STAFF.

465. PUBLIC SCHOOL FINANCE AND BUSINESS ADMINISTRATION. The theory and practice of financing public education in the United States. Development of guiding principles in educational finance, trends and needs in state and federal participation in school support, and local operational finance. II and alternate summers; 1 unit. Prerequisite: Education 460; experience in teaching or administration. Not open to students who have completed Education 461 or 462. MCLURE, MILLER.

466. ADMINISTRATIVE LEADERSHIP. This course considers the generalized procedures (based on principles underlying democratic leadership drawn from philosophy, psychology, and sociology) by which the administrator may work with and through people to develop and operate effective educational programs in public school systems. II; 1 unit. Prerequisite: Education 405 and 460. MILLER.

467. THE AMERICAN COLLEGE. Development of the American college and university, public and private, conflicting theories; present trends. II; 1 unit. BENNER.

468. PUBLIC RELATIONS OF THE SCHOOLS. Study of the interrelationships between the lay community and the schools. Appraisal of procedures, actual or proposed, for the improvement of these relationships. I; 1 unit. BENNER.

469. LEGAL BASIS OF SCHOOL ADMINISTRATION. The legal rights, privileges, responsibilities, immunities, and authority of pupils, parents, teachers, administrators, and school board members in relation to the school. I; 1 unit. SUMPTION.

471. PLANNING PROGRAMS OF AGRICULTURAL EDUCATION IN COMMUNITY SCHOOLS. The community school concept, applications to agricultural education; relationships of agricultural education to community study and planning,

using advisory groups; objectives; evaluation; program-planning; school and community relationships; department management; facilities. I; 1 unit. Prerequisite: Education 276 and 277. Open to school administrators without prerequisites. HAMLIN.

472. AGRICULTURAL EDUCATION IN SECONDARY SCHOOLS. Place of agricultural education in secondary schools; functions of vocational and non-vocational agriculture; coordination of class work; supervised farming; and the F.F.A.; guidance; course planning; teaching procedures and aids; facilities. I; ½ unit. Prerequisite: Education 276 and 277. DEYOE.

473. VOCATIONAL EDUCATION IN AGRICULTURE FOR ADULTS. The case for adult education, adult education in the public schools, needs of young and adult farmers for education, development and present status of adult education in agriculture, objectives, evaluation, organizing adult classes, course planning, teaching procedures and aids, supervised practice, group activities, facilities. II; ½ unit. Prerequisite: Education 276 and 277. HAMLIN.

474. SUPERVISED FARMING IN VOCATIONAL AGRICULTURE. Importance and meaning of supervised farming; evaluation of supervised farming; relation to establishment in farming; selecting and planning farming programs; records; related instruction; supervision; nature of supervised farming for students in day-school, young farmers, and adult farmers classes. II; ½ unit. Prerequisite: Education 276 and 277. DEYOE.

476. GUIDANCE IN AGRICULTURAL EDUCATION. The guidance function in high school, young farmers and adult farmers classes, determining and preparing for agricultural opportunities, personnel included in vocational classes, preparation of plans for teaching about agricultural occupations, tests and other aids in guidance, establishment in farming, placement, follow-up. S; ½ unit. Prerequisite: Education 276 and 277.

477. FIELD STUDIES IN AGRICULTURAL EDUCATION. Open only to students who have completed Education 471, 472, 473, 474, or 476, and who have submitted satisfactory plans for field work related to one of these courses. Two meetings of eight hours each on campus. Registration on campus at usual registration times. I, II; ½ unit. Maximum credit, 1 unit. DEYOE, HAMLIN, PHIPPS.

478. SEMINAR IN AGRICULTURAL EDUCATION. Needs for and contributions of research in agricultural education, review and criticism of research studies, methods of research in agricultural education, planning of a comprehensive study or completion of a small study. I; ½ unit. Prerequisite: Two graduate courses in agricultural education. HAMLIN.

479. EDUCATION OF TEACHERS OF AGRICULTURE. Critical review of teacher-education programs in operation; recruiting, guidance, and selection of trainees; objectives; evaluation; curricula and courses, student teaching; in-service training; facilities, administration; financing; selection and training of the teacher-education staff. II; ½ unit. Prerequisite: Two graduate courses in agricultural education.

481. HISTORY AND FUNDAMENTAL CONCEPTS OF VOCATIONAL EDUCATION. A course in the historical development of modern vocational education, the educational theories underlying its development, and the educational concepts upon which present programs and procedures are based. I; 1 unit. MAYS.

482. RESEARCH IN INDUSTRIAL EDUCATION. Study and evaluation of examples of research in this field; a consideration of the research needed to solve present problems. Each student will propose and complete a brief research, or plan in detail a major research project to be completed later. II; 1 unit.

487. Seminar in Industrial Education and Vocational Guidance. I; 1 unit. Mays.

488. Curriculum Problems and Trends in Industrial Education. Selection and organization of instructional materials for industrial courses. Study of basic concepts underlying course construction in industrial education. II; 1 unit. Offered in 1950-1951 and in alternate years. Prerequisite: Undergraduate work in industrial education. Mays.

489. Administration and Supervision of Industrial Education. Problems and approved practices in the administration and supervision of programs of industrial education in the secondary schools. II; 1 unit. Offered in 1951-1952 and in alternate years. Prerequisite: Undergraduate work in industrial education. Mays.

490. Seminar for Advanced Students of Education. Open only to persons who have been admitted to candidacy for the degrees of Ph.D. or Ed.D. and have completed the preliminary examination. Sections of this seminar will usually be offered in the following areas: (a) philosophical and social foundations of education, (b) psychological foundations of education, (c) elementary education, (d) secondary education, (e) educational administration, (f) guidance and counseling, (g) education of the exceptional child, (h) industrial arts and vocational education, (i) agricultural education, and (j) home economics education. I, II; 1 to 2 units. Staff.

491. Thesis. Individual direction in research and guidance in writing thesis for advanced degrees. I; 1 to 4 units. Staff.

492. Thesis. Individual direction in research and guidance in writing thesis for advanced degrees. II; 1 to 4 units. Staff.

495. Theory of Measurement in Education. The principal theories of test construction and design, psychophysical and psychometric methods of measurement, the criterion problem and techniques of validation, test reliability theory, the theory of measurement as it functions in modern conceptions of educational practice, and the appraisal of educational programs. I; 1 unit. Prerequisite: Education 496; Education 423 or 498.

496. Statistical Methods in Education. First graduate course in statistical methods in education. Includes an introduction to the logic of scientific method in education; probability and sampling in education, correlation methods in educational measurements and research; partial and multiple correlation and the testing of statistical hypotheses; and other applications of statistics to educational research. I; 1 unit. Prerequisite: Education 390. Cornell.

497. Advanced Statistical Methods in Education. An advanced course in statistical methods applied to educational research. Statistical estimation, analysis of variance and co-variance, statistical design of experiments, introduction to factor analysis, the use of mathematical models in educational theory. II; 1 unit. Prerequisite: Education 496. Cornell.

498. Theory of Educational Evaluation. Study of relationship between educational purposes, curriculum, and evaluation through emphasis on principles of evaluation dealing with classifications of behavior. A detailed study of the concept of test validity, of its determination, and of its relation to test design. Emphasis on the evaluation of outcomes involving the higher mental processes. Guided practice in solving complex problems of evaluating behaviors, some in subject matter areas but primarily those cutting across subject matter lines. II; 1 unit. Prerequisite: Education 496.

499. Field Study and Thesis Seminar. This seminar will usually be required of candidates for the degree of Doctor of Education who are taking major work in one of the following areas: (a) philosophical and social foundations of education, (b) secondary psychological foundations of education, (c) elementary education, (d) secondary education, (e) educational administration, (f) guidance and counseling, (g) education of the exceptional child, (h) industrial arts and vocational education, (i) agricultural education, and (j) home economics education. The purpose of the seminar is to assist doctoral candidates in planning field studies and thesis problems. Each student will be expected to present his study at each of four stages in its development: (1) the inception, delimitation, tentative design stage; (2) the proposed design stage; (3) the revised design stage; (4) the final design stage. Students will be expected to analyze critically all presentations. Limited to Ed.D. candidates. I, II; 1 to 2 units. Staff.

Courses for Graduates and Advanced Undergraduates

300. The History of Education. Brief, introductory summary of ancient and medieval education followed by a more extended study of educational developments since the Italian Renaissance. Special emphasis placed on the relation of educational trends to broader social, economic, political, and intellectual movements. I, II; ½ unit. Anderson.

301. Philosophy of Education. Based on a careful and critical reading of selected chapters from John Dewey's *Democracy and Education.* Designed to develop competencies in (1) locating and criticizing basic assumptions of an educational argument, (2) examining and criticizing basic assumptions about educational purposes and practices, and (3) examining and testing systematic relationships between educational ideas and assumptions, etc. I, II; ½ unit.

302. History of American Education. The development of theory and practice in American education in relation to political, social, and cultural developments. I, II; ½ unit. Anderson.

303. Comparative Education. General foundations course designed to contribute to professional competence in dealing with these educational problems requiring an understanding of the relationship of education to a particular society. A study of selected national systems of education in their differing cultural settings. I, II; ½ unit. Kaulfers.

304. Social Foundations of Education. An introductory survey of the interrelationship between school and society and of the impact on public education of the major social trends and forces operating in our society. Designed to develop competencies in (1) understanding of the role of the culture in shaping both human personality and social institutions, (2) evaluating the effects of the various welfare and class levels in the United States on the lives of children and adults and on the work of the school, and (3) understanding major elements operating in the social crisis of our time and the impact of these elements on education. I, II; ½ unit. Benne, Stanley.

311. Psychology of Learning for Teachers. A consideration of learning situations in the light of psychological findings and concepts. Development of a theory of learning, and its application to the teaching of attitudes, skills, and understandings. I, II; ½ unit. Prerequisite: Education 211, and practice teaching or teaching experience. Blair, Potthoff, Simpson, Woodman.

312. Mental Hygiene and the School. A consideration of social and emotional adjustment. Study of normal personality, integration, feelings of inferiority, adjustment mechanisms, classroom therapy, behavior disorders in children, and introduction to methods of child study and provision for emotionally disturbed children. I, II; ½ unit. Prerequisite: Education 211, and practice teaching or teaching experience. Blair, Potthoff, Simpson, Woodman.

315. Sociology of Education. Same as Sociology 315. Objective comparative study of education as a social process in various cultures and historical periods, with main emphasis on present education in countries which share Western civilization. I or II; ½ unit. Prerequisite: Sociology 100. Shideler.

317. Exceptional Children. An introduction to the study of children who deviate from the average in mental, physical, and social characteristics. The course includes a study of the characteristics of such children and the adaptation of educational procedures to their abilities and disabilities. I, II; ½ unit. Prerequisite: Psychology 100. Brill, Kirk.

318. Workshop and Laboratory in Education of Exceptional Children. Observation of special laboratory classes of various types of exceptional children; group discussions; conferences with specialists as consultants; work on a project of particular concern to the individual student. S; 1 unit for four weeks; 2 units for eight weeks. Prerequisite: Senior standing.

319. Special Education of the Deaf. Survey of the curriculum and techniques in pre-schools, kindergartens, and primary and intermediate levels as applied to the hard-of-hearing, deafened, and deaf child. A study of sense training, lip reading, vocabulary development, reading techniques, language and speech development, auditory training, and curriculum construction. I; 1 to 1½ units. Prerequisite: First three years of curriculum for teachers of the deaf, or equivalent. Brill.

320. Special Education of the Deaf. Continuation of Education 319. II; 1 to 2 units. Prerequisite: Education 319. Brill.

321. Care and Education of Orthopedically Handicapped Children. Survey of orthopedic handicaps in children, psychological and social effects of such handicaps, and the kinds of schools and services provided for the education of the various types of crippled children. The education of the cerebral palsied child is emphasized. S; 1 unit. Prerequisite: A teacher's certificate, or senior standing, or a major in some area of special education.

322. Psychology and Education of the Mentally Handicapped. A study of the social, emotional, physical, and learning characteristics of mentally handicapped children; methods of diagnosis and differentiation; educational organization and teaching techniques employed for their rehabilitation. I; ½ unit. Prerequisite: Education 231; senior standing. Kirk.

323. Psychology and Education of the Mentally Handicapped. Continuation of Education 322, with emphasis on curriculum. II; ½ unit. Prerequisite: Education 322. Kirk.

324. Mental and Educational Measurement of Exceptional Children. Designed to develop an understanding of and ability to interpret the results of psychological and educational tests. Practice is provided in test administration, with emphasis on diagnosis and problems encountered in testing

acoustically handicapped, orthopedically handicapped, visually handicapped, mentally handicapped, and defective of speech. II; ½ unit. Prerequisite: Education 317, or consent of instructor. KIRK.

336. PRIMARY READING. Critical evaluation of current schools of thought with regard to the teaching of reading and an analysis of the concept of learning as well as the meaning of reading upon which each school is based. Attention is given to reading as a part of the total growth process of the child and to knowledge of methods and materials used in teaching beginning reading. I, II; ½ unit. Prerequisite: Education 101, 201, and 230. STENDLER.

337. ART EDUCATION IN THE ELEMENTARY SCHOOL. Methods, plans, and materials for teaching art as an integral part of the total educational program in the elementary school. I, II; ½ unit. Prerequisite: Education 101, 201, and 230. SCHULTZ.

354. AUDIO-VISUAL MATERIALS AND PROBLEMS. Audio-visual materials will be examined from the point of view of their effectiveness and possible utilization in the school program. Recent investigations on materials and methods of presentation will be studied to ascertain their pedagogical implications. The technical and administrative problems of integrating audio-visuals into the school curriculum are considered. I, II; ½ unit. Prerequisite: Education 211, 231, or 241; senior standing. PETERSON.

370. AGRICULTURAL EDUCATION FOR FIRST-YEAR TEACHERS. Specific help with the problems of beginning teachers. Campus meetings in August and November. Other meetings in centers in the state convenient to first-year teachers. Visits by instructor to schools in which first-year teachers are employed. I; ½ unit. Prerequisite: Education 276 and 277. PHIPPS.

381. PRINCIPLES OF VOCATIONAL EDUCATION. Study of basic concepts and practices of modern vocational education. I, II; 1 unit. MAYS.

383. PROBLEMS OF INDUSTRIAL EDUCATION. A survey of the problems and practices of the several phases of industrial education. I, II; 1 unit. MAYS.

385. PRINCIPLES OF VOCATIONAL GUIDANCE. Basic concepts and practices of vocational guidance in public schools. What the teachers can do in vocational guidance. I, II; 1 unit. MAYS.

390. ELEMENTS OF EDUCATIONAL STATISTICS. Designed for terminal value for professional training of students not intending to pursue advanced graduate work, and for introductory value for students continuing graduate study in education. The course includes descriptive statistics, the nature of measurement in education, introduction to regression, correlation analysis, statistical inference, and the presentation and interpretation of statistical data in educational literature. I, II; 1 unit. ODELL.

391. INTRODUCTION TO EVALUATION. Practice and demonstration of the techniques of measurement with particular emphasis on their relation to the principles of educational evaluation and to a technique of curriculum development. The student will have an opportunity to practice the techniques in his major field. Such topics as certain relevant statistical concepts, the planning of a school evaluation program, and the use of standardized achievement tests are also considered. I, II; 1 unit. HASTINGS.

ELECTRICAL ENGINEERING

Graduate work in electrical engineering leading to the degree of Master of Science in Electrical Engineering and Doctor of Philosophy in Engineering is offered to graduates of electrical engineering curricula substantially equivalent to that of the University of Illinois in the option in which advanced work is desired. The fields of specialization are communication and electronic engineering, illumination, and power engineering. Graduates of curricula in the physical sciences and mathematics may also be admitted to advanced study if they have the necessary background to profit from graduate work in electrical engineering. An applicant's undergraduate grade-point average must be at least 3.75 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students on limited status will not be admitted to graduate work in this department.

Courses for advanced undergraduates and graduates are also open for credit to students with a major in other departments, who have the proper prerequisites.

The objectives of a well-rounded graduate program in electrical engineering may be classified into four areas:

(1) The development of a more thorough understanding of the basic fundamentals of electrical engineering.

(2) Development of better tools for the solution of electrical engineering problems.

(3) Uncovering of special characteristics of initiative and resourcefulness.

(4) Development of a specialist's understanding in some area of the electrical engineering field.

No standard program can be set up which will fit the needs of all graduate students. The varying maturity and purposefulness of graduate students will require individuality in their programs.

To help determine his program, each student takes a written placement examination in electrical engineering to determine the extent of his background. This examination is diagnostic in character, and the results are expected to provide suggestions for further study, either formal or informal. With the help of the diagnostic examination, a faculty adviser is appointed for each entering graduate student. The adviser and the student together work out the program which the student is to follow.

It is expected that the student will enroll in such additional mathematics work as a review of his training and the field in which he specialized would indicate advisable. Advanced courses in mathematics, physics, chemistry, mechanics, and in other branches of engineering are suggested as suitable minor subjects.

Communication and Electronic Engineering. It is recommended that graduate students specializing in this field acquire a general knowledge of the whole field as well as a specialized knowledge of some part of it. Therefore, it is suggested that Electrical Engineering 410, 414, 420, 422, and 423 be taken as early in the program as possible.

For students interested in industrial electronics, it is suggested that Electrical Engineering 410, 413, 429, 430, and 442 as well as other engineering courses in mechanism, machine design, and vibrations, be included in a well-rounded course of study.

For graduate work in communication and electronics, the student should offer the equivalent of the following undergraduate courses: Electrical Engineering 330, 331, 332, and 333, Electrical Machinery; 340, 341, and 349, Electronics; 351, Networks and Lines; 353 and 355, Communication Engineering; and Differential Equations.

Students with deficiencies must expect to satisfy these requirements.

Illumination Engineering. The courses in illumination are designed to provide an analytic basis for illumination engineering, rather than develop the theory of light and photometry. Mathematical analysis is applied to illumination design and the answers are compared with the results found in practice.

It is suggested that Electrical Engineering 410, 460, and 461 be taken as early in the program as possible and that the student also include vector analysis during the course of his work. Research work may be in the theory and practice of illuminating engineering or colorimetry.

For graduate work in illumination, the student should offer the equivalent of the following undergraduate courses: Electrical Engineering 320, 321, 322, and 323, Circuit Analysis; 330, 331, 332, and 333, Electrical Machinery; 340 and 341, Electronics; 268, Illumination; and Differential Equations.

It is expected that the student will have some preparation in light, physiology, and psychology. Students with deficiencies must expect to satisfy these requirements.

Power Engineering. Graduate work in the power option falls naturally into the fields of circuits, machinery, and power systems. To provide a suitably broad base and assure adequate preparation for the courses to follow, it is suggested that Electrical Engineering 410, 414, 440, 442, and 444 be taken as early in the program as possible.

For graduate work in power, a student should offer the equivalent of the following undergraduate courses: Electrical Engineering 334, 335, 336, 337, 338, 339, Electrical Power Apparatus; 340 and 341, Electronics; Differential Equations.

Students with deficiencies must expect to satisfy these requirements.

The courses listed below indicate by their content the general field to which they belong. It is recognized that the candidate for the master's degree would not take all of the courses in a particular field, while a candidate for the doctor's degree might expand the listing through a study of special problems. To provide broadness as well as depth, a student should include some courses which are not in his chosen option.

Fellowships

The Galvin Fellowship is offered annually by Motorola, Inc., of Chicago, to a graduate student in electrical engineering majoring in the field of radio engineering. It is awarded with a stipend of $750 on recommendation of the Department of Electrical Engineering.

One fellowship is offered annually by the Westinghouse Educational Foundation, Pittsburgh, Pennsylvania, to a graduate student in electrical engineering. It is awarded with a stipend of $1,000 upon recommendation of the Department of Electrical Engineering.

Other industrial fellowships are available from time to time.

The Urbana Section of the American Institute of Electrical Engineering annually offers awards totaling $25 for the best papers submitted by graduate students in electrical engineering in a competition usually held in the spring of the year.

Graduate Teaching Faculty

Professors: J. D. Ryder (Head of Department), W. L. Everitt, M. A. Faucett, G. H. Fett, V. P. Hessler, E. C. Jordan, J. O. Kraehenbuehl, C. A. Keener, A. R. Knight, M. B. Reed, E. A. Reid.

Associate Professors: L. B. Archer, H. N. Hayward, M. S. Helm, H. W. Horn, T. A. Murrell, C. C. Nash, P. F. Schwarzlose, C. E. Skroder, N. Wax.

Assistant Professors: A. D. Bailey, W. H. Byers, W. J. Fry, W. E. Miller, R. M. Wainwright, H. D. Webb.

Courses for Graduates

400. Seminar. Required of all graduate students. I, II; no credit. Ryder.

410. Engineering Analysis. Static and dynamic field problems with emphasis on the relationships between the various branches of engineering and the development of the use of mathematics as a tool in the solution of complex problems. I, II; 1 unit. Hessler.

412. Advanced Engineering Measurements. Theory and practice of precision measurements of electric, magnetic, and physical quantities; factors influencing the choice of method. Comparative accuracy and practicability of measurement methods and limitation of technique; evaluation of errors; design and development of measurement apparatus and methods. I, II; 1 unit. Hayward.

413. Servomechanisms and Automatic Control Devices. Fundamental theory of servomechanisms and other automatic control devices, electrical analogies, stability, transfer functions, and on-off mechanisms. I, II; 1 unit. Fett.

414. Foundations of Electrical Network Theory I. Formulation and study of foundation axioms of electrical networks, topological basis of mesh and node methods, mesh and node equations by means of matrix transformations, and general proofs of standard network theorems. I; 1 unit. Reed.

415. Foundations of Electrical Network Theory II. A detailed study of the response of lumped electrical networks by matrix transformation of the generalized mesh and node methods. II; 1 unit. Reed.

420. Electromagnetic Waves and Radiating Systems. Fundamental electromagnetic theory with applications to transmission lines, wave guides, and antennas. I, II; 1 unit. Jordan.

421. Advanced Electromagnetic Engineering. Cylindrical and spherical electromagnetic waves; radiation and diffraction; advanced antenna theory; ground and sky wave propagation. I, II; 1 unit. Prerequisite: Electrical Engineering 420. Jordan.

422. Advanced Communication Networks. Fourier integral and matrix algebra, analysis of networks, and network synthesis for wide band operation. I, II; 1 unit. Skroder.

423. Electron and Ion Dynamics. Laplace equation, conformal transformations, Poisson's equation with initial velocities and transit time, electron optics, and electron ballistics of klystrons and magnetrons. I, II; 1 unit. Prerequisite: Credit or registration in Electrical Engineering 420. Wax.

424. Theory of Gaseous Discharge Devices. Motion of ions and electrons; ionization and deionization; space charge and plasma; glow and arc discharges; circuit interruption; arc extinction problems. I, II; 1 unit. Webb.

425. Photoelectric and Thermionic Phenomena. Experimental basis for thermionics, thermoelectricity, and photoelectricity; thermodynamics of electron emission and thermoelectricity; basis of quantum statistics and application to thermionics and photoeffect. I, II; 1 unit. Murrell.

426. Electroacoustical Systems. A study of the solutions of differential equations of wave motion with applications to vibrating strings, membranes, rods, sonic systems, loud speakers, microphones, galvanometers. I, II; 1 unit. Fry.

427. Boundary Value Problems. Derivation and solution of partial differential equations and integral equations of mechanics and electricity and magnetism; study of the analysis of wave motions. I, II; 1 unit.

428. Nonlinear Oscillating Systems. Criteria for stability of nonlinear oscillations; nonlinear resonance; study of analytical methods; harmonics and subharmonics, and relaxation oscillations. I, II; 1 unit.

429. Vacuum Tube Circuit Analysis. Vacuum tube network theory, feedback circuits and amplifiers, stability, equalizers, and relations between components of network functions. I, II; 1 unit. Fett.

430. Gas Tube Circuit Analysis. Equivalent circuit of gas tubes at low and high frequencies, circuit analysis, and rectifiers. II; 1 unit. Ryder.

431. Microwave Circuits. Four terminal networks and transmission line theory, bilinear transformations, wave guides, the generalized impedance concept, expansion of fields in normal modes, resonant cavities, and measurement techniques. I, II; 1 unit. Prerequisite: Electrical Engineering 420. Jordan.

432. Passive Network Design — Real Frequency Techniques. A study of the latest techniques of electric filter design in terms of the real frequency properties of purely reactive networks. I; 1 unit. Reed.

433. Transmission of Information. II; 1 unit. Prerequisite: Electrical Engineering 422. Wax.

440. Advanced Power Circuit Analysis I. Special methods of polyphase circuit analysis, transients in multiple loop lumped constant circuits by differential equations and by Heaviside expansion theorem, and study of circuits having nonlinear parameters by step-by-step method. I, II; 1 unit. Knight.

441. Advanced Power Circuit Analysis II. Transients in multiple loop lumped constant circuits by Fourier integral and by Laplace transforms, and study of steady state relations and transients in distributed constant circuits. I, II; 1 unit. Prerequisite: Electrical Engineering 440. Knight.

442. Advanced Analysis of Alternating Current Machinery. Steady state analysis of synchronous machines, round rotor and salient poles, magnetomotive forces with symmetrical and unsymmetrical windings, torque angle characteristics, vibration, and noise. I, II; 1 unit. Keener.

443. Analysis of Dynamo Machines Under Transient Conditions. Analysis of the operation of alternating and direct current machines under transient conditions, armature and field phenomena and mutual reactions of dynamo machines with system transients. I, II; 1 unit. Prerequisite: Electrical Engineering 442. Keener.

444. Advanced Power System Analysis. Electrical and mechanical properties of transmission systems, calculations of fault currents, power diagrams, and power limits. I, II; 1 unit. Prerequisite: Electrical Engineering 440. Faucett.

445. Power System Transients and Stability. Steady state power limits, criteria for loss of synchronism, effects of voltage regulation, exciters, and steady state as influenced by dynamic stability. I, II; 1 unit. Prerequisite: Electrical Engineering 444. Faucett.

446. Electrical Design (Apparatus). Properties of materials, field mapping, leakage fields, cooling and rating of apparatus, limitations affecting design, prediction of operating characteristics, and special design problems. I, II; 1 unit. Prerequisite: Preparation substantially equivalent to the power option in the undergraduate electrical engineering curriculum. Archer.

447. Electrical Design (Power System). Sources of energy, location of generating stations, selection of units, location of transmission lines, layouts of systems, and extension of established systems. I, II; 1 unit. Faucett.

460. Treatment of Experimental Illumination Data. Representation of data by tables, graphs, and equations, tabular and graphical differentiation and integration, normal frequency distribution, measure of averages, variability and relationship, indexes and adjustment of measurements. Methods applied to observations made with both light and illumination as part of human environment. I, II; 1 unit. Kraehenbuehl.

461. Methods of Illumination Calculations. Fundamentals of the light field, illumination in space, the light vector, plots of fields, and applications of light fields to engineering problems. I, II; 1 or 2 units. Kraehenbuehl.

462. Colorimetry in Illumination. Color vision, color of sources, surfaces and filters, direct measurements of spectral distributions, methods of computing tristimulus values and chromaticity coefficients, color temperature, color systems and their interrelation, linear and homogeneous transformation, color discrimination, and harmony and applications. I, II; 1 unit. Kraehenbuehl.

463. Advanced Illumination Sources. Theory of incandescent and luminescent sources of illumination; radiation characteristics of ultra-violet and infrared phosphors. Colorimetric specifications of sources; line spectra of gas discharges. Minimum perceptible color differences as applied to the I.C.I. chromaticity diagram. I, II; 1 or 2 units. Miller.

464. Advanced Illumination Design. Design of lighting equipment for both utility and comfort, control of glare through proper brightness contrasts, design for special applications, and design of floodlighting and streetlighting equipment. I, II; 1 or 2 units. Horn.

491. Thesis. I; ¼ to 4 units. Staff.

492. Thesis. II; ¼ to 4 units. Staff.

493. Research. I; ½ to 4 units. Staff.

494. Research. II; ½ to 4 units. Staff.

497. Electrical Engineering Problems. Special electrical engineering problems. I; ½ to 2 units. Staff.

498. Electrical Engineering Problems. Special electrical engineering problems. II; ½ to 2 units. Staff.

Courses for Graduates and Advanced Undergraduates

306. Direct and Alternating Current Circuits. Fundamental electric and magnetic units; direct and alternating current circuit analysis; complex numbers and vector diagram solutions. I, II; 0 to ¾ unit. Prerequisite: Physics 103 and 104; Mathematics 142 or 147; credit or registration in Electrical Engineering 307.

307. Direct and Alternating Current Laboratory. Circuits laboratory accom-

panying Electrical Engineering 306. I, II; 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 306.

308. Direct and Alternating Current Apparatus. Generators and motors, transformers, rectifiers, and electronic devices. I, II; 0 to ¾ unit. Prerequisite: Electrical Engineering 306 and 307; credit or registration in Electrical Engineering 309.

309. Direct and Alternating Current Laboratory. Machines laboratory accompanying Electrical Engineering 308. I, II; 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 308.

320. Circuit Analysis. Detailed and analytical solution of periodic current circuits; networks and network theorems; coupled circuits. I, II; 0 to 1 unit. Prerequisite: Electrical Engineering 126; Physics 104; credit or registration in Mathematics 341 or 342 or 343 or 345 and Electrical Engineering 321.

321. Circuit Laboratory. To accompany Electrical Engineering 320. I, II; 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 320.

322. Circuit Analysis. Continuation of Electrical Engineering 320. Wave analysis; three phase circuits; three phase power and energy measurements; symmetrical components analysis; filters; transients. I, II; 0 to 1 unit. Prerequisite: Electrical Engineering 320 and 321; credit or registration in Electrical Engineering 323.

323. Circuit Laboratory. To accompany Electrical Engineering 322. I, II; 0 to ¼ unit. Prerequisite: Electrical Engineering 320 and 321; credit or registration in Electrical Engineering 322.

327. Theory of Measurements. Precise measurement of electrical quantities and the application of measurement theory to engineering problems. I, II; 0 to 1 unit. Prerequisite: Electrical Engineering 322.

330. Electrical Machinery. Transformers and polyphase induction motors. I, II; 0 to ¾ unit. Prerequisite: Electrical Engineering 322 and 323; credit or registration in Electrical Engineering 331.

331. Electrical Machinery Laboratory. To accompany Electrical Engineering 330. I, II; 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 330.

332. Electrical Machinery. Synchronous machines, single-phase motors, direct-current machines, application. I, II; 0 to ¾ unit. Prerequisite: Electrical Engineering 330 and 331; credit or registration in Electrical Engineering 333.

333. Electrical Machinery Laboratory. To accompany Electrical Engineering 332. I, II; 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 332.

334. Electrical Power Apparatus. Single and three-phase transformers. I, II; 0 to ¾ unit. Prerequisite: Electrical Engineering 320 and 321; credit or registration in Electrical Engineering 322, 335.

335. Electrical Power Apparatus Laboratory. To accompany Electrical Engineering 334. I, II; 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 334.

336. Electrical Power Apparatus. Synchronous and induction generators and motors. I, II; 0 to ¾ unit. Prerequisite: Electrical Engineering 334 and 335; credit or registration in Electrical Engineering 337.

337. Electrical Power Apparatus Laboratory. To accompany Electrical Engineering 336. I, II; 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 336.

338. Electrical Power Apparatus. Direct-current generators and motors, converters, single-phase motors, frequency changers, duty cycles. I, II; 0 to ¾ unit. Prerequisite: Electrical Engineering 336 and 337; credit or registration in Electrical Engineering 339.

339. Electrical Power Apparatus Laboratory. To accompany Electrical Engineering 338. I, II; 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 338.

340. Electronics. High-vacuum electron tubes, emission, electron ballistics, tube characteristics, equivalent circuits, linear amplifier circuits and characteristics, gas tubes, phototubes. I, II; 0 to ¾ unit. Prerequisite: Electrical Engineering 320 and 321; credit or registration in Electrical Engineering 341.

341. Electronics Laboratory. To accompany Electrical Engineering 340. I, II; 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 340.

349. Electron Tube Circuits. Linear and nonlinear amplifiers, fundamentals of modulation and detection, oscillators, rectifiers. I, II; 0 to 1 unit. Prerequisite: Electrical Engineering 322, 323, 340, and 341; credit or registration in Electrical Engineering 353.

351. Networks and Lines. Reactance networks, general transmission line equations, low-loss lines, reflections. I, II; 0 to 1 unit. Prerequisite: Electrical Engineering 320 and 321; credit or registration in Electrical Engineering 322.

353. Radio Circuits. Impedance transformation, reactance network synthesis as applied to radio frequencies; modulation theory; principles of receivers and transmitters. I, II; 0 to 1 unit. Prerequisite: Electrical Engineering 322, 340, and 351; credit or registration in Electrical Engineering 349.

355. Fields and Waves. Theory of VHF and microwave generators; electromagnetic fields, radiation and propagation of electromagnetic energy, radiating systems. I, II; 0 to 1 unit. Prerequisite: Electrical Engineering 349 and 353.

361. Elements of Illuminating Engineering Design. Application of the fundamentals of optics and light to developments in the design of illumination equipment and lighting installations. I, II; 0 to ½ unit. Prerequisite: Mathematics 132 and 142; Physics 104; Electrical Engineering 260.

362. Principles of Illuminating Engineering. Concept and units in light calculations; calculation of illumination from point, line, and surface sources; interpretation of photometric and test data. I, II; 0 to ¾ unit. Prerequisite: Electrical Engineering 260; credit or registration in Electrical Engineering 363; Mathematics 345; Physics 270.

363. Illumination and Photometry Laboratory. Photometry and illumination measurements. I, II; 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 362.

364. Illumination Design and Economics. Design of lighting systems for natural and artificial illumination; applications for interiors and exteriors in both commercial and industrial installations; economic studies; design of reflectors and lighting equipment. II; 0 to ¾ unit. Prerequisite:

Electrical Engineering 362 and 363; credit or registration in Electrical Engineering 365.

365. Illumination Design Laboratory. To accompany Electrical Engineering 364. Checking and constructing equipment and installation designs in lighting. II; 0 to ¼ unit. Prerequisite: Credit or registration in Electrical Engineering 364.

366. Illumination Sources. Study of natural and artificial light sources covering combustion, incandescent, and gaseous lamps, with emphasis on fundamental laws; radiation measurements and colorimetry. II; 0 to ½ unit. Prerequisite: Credit or registration in Electrical Engineering 364 and 365.

374. Electrical Energy Measurements and System Protection. Transmission equipment, energy meters, protective relays. I, II; 0 to ¾ unit. Prerequisite: Registration in Electrical Engineering 334, or consent of instructor.

375. Energy Measurement and Protection Laboratory. To accompany Electrical Engineering 374. I, II; 0 to ¼ unit. Prerequisite: Registration in Electrical Engineering 374.

376. Power Circuit Analysis. Advanced analysis of circuits used for power transmission and distribution. I, II; 0 to 1 unit. Prerequisite: Electrical Engineering 322 and 323.

378. Fundamentals of Power Transmission Engineering. Fundamentals of electrical and mechanical design of power transmission systems. I, II; 0 to 1 unit.

379. Power Transmission. Advanced analysis of electric power transmission systems, faults, stability. II; 0 to ¾ unit. Prerequisite: Electrical Engineering 336, 337, and 378.

380. Illuminating Engineering. A second course in illumination, covering units, sources, point and surface illumination, design, and economics. I; 0 to ½ unit.

381. Pulse Techniques. Response of electrical systems to repeated transients. I, II; 0 to 1 unit. Prerequisite: Electrical Engineering 349 and 353.

382. Principles of Electric Communication Engineering. Survey of electric communications, networks, infinite line, coupled circuits, R.F. amplifiers, inductive coordination. Not open to students with credit in Electrical Engineering 351, 353, and 355. II; 0 to ¾ unit. Prerequisite: Electrical Engineering 322, 323, 341, and 350; registration in Electrical Engineering 383.

383. Principles of Electrical Communication Engineering Laboratory. To accompany Electrical Engineering 382. II; 0 to ¼ unit. Prerequisite: Registration in Electrical Engineering 382.

386. Fundamentals of Servomechanisms. Fundamental knowledge required in the analysis of servomechanisms and automatic control devices. II; 0 to 1 unit. Prerequisite: Consent of instructor.

387. Electrical Design. Fundamental principles of electrical power apparatus design with particular application to transformers and generators. Properties of materials in common use; construction of coils; magnetic attraction; stored energy; field mapping; heat dissipation; temperature rise and rating of apparatus. For students selecting the option in power. I, II; 0 to 1 unit. Prerequisite: Electrical Engineering 332 and 333, or registration in Electrical Engineering 334 and 335.

389. Communication Design. Design, construction, and complete test of a radio transmitter or receiver. I, II; 0 to 1 unit. Prerequisite: Electrical Engineering 349 and 353.

ENGLISH LANGUAGE AND LITERATURE

(Including American Literature and Rhetoric)

The Department of English offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy. Students who enter graduate work with English as their major subject must have attained a grade-point average of 3.75 or higher for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. (Students are not admitted to graduate work in English on limited status.) They must give evidence of their ability to write good English, and they must present the equivalent of fourteen hours of undergraduate work in English literature, the required college work in rhetoric, and the equivalent of four semesters of college work in Latin, Greek, French, or German. After the first year of graduate work a knowledge of French and German is indispensable. Students making English their minor may be admitted to such courses as in the judgment of the instructor in charge they are qualified to pursue.

Degree of Master of Arts in English. In addition to satisfying the general requirements of the Graduate College, candidates for the degree of Master of Arts in English are required (1) to choose most of their work from courses at the 400 level listed below, and (2) to pass a qualifying examination.

This is a three-hour written examination devised to test the student's possession of the knowledge of English and American literature which an undergraduate English major may be reasonably expected to have acquired. It must be taken early during the student's first term of residence at a time designated by the Department. Students who fail this examination are permitted to take it once again. As a guide to prospective candidates, it is suggested that the following undergraduate courses or their equivalent will best fit the pattern of the examination: (1) a reading course in Shakespeare, (2) a course in one other major writer (e.g., Chaucer, Milton, or Dryden), (3) a course in a period of literature (e.g., the Renaissance or the eighteenth century), and (4) a survey of English literature.

Degree of Master of Arts in the Teaching of English. Candidates for the degree of Master of Arts in the Teaching of English must earn four units in English, two units in education, and two units in electives. Requirements are: English, four units (students who intend to teach in junior college should take Rhetoric 480); education, two units, including two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit. The courses in English and the electives must be selected with the approval of the Head of the Department. The electives may be in English, in education, or, in exceptional cases, in other subjects. Candidates for this degree should consult Professor J. N. Hook, 121 Lincoln Hall.

Degree of Doctor of Philosophy in English. Candidates for the degree of Doctor of Philosophy in English may expect to be examined on the entire field of English language and literature. Candidates with literature as a major will take philology as a first minor. They are urged, furthermore, to acquaint themselves as fully as possible with the history and philosophy of the period in which

their main interest lies, and with the foreign languages and literature most closely related to English and that period. Further information concerning the requirements for this degree is provided in the departmental pamphlet, which may be obtained at 204a Lincoln Hall.

Assistantships

Teaching assistantships in English are available to graduate students who wish to combine teaching experience with progress toward advanced degrees. Applicants with the A.M. degree are eligible for full-time assistantships paying $2,400 on a nine-month contract. Students given such appointments ordinarily teach three three-hour classes of Freshman Rhetoric. Those who are working toward the A.M. degree and those who wish to progress more rapidly toward the doctorate may be considered for two-thirds time ($1,600) or one-third time ($800) appointments. All appointments to assistantships are for nine months only but may be renewed annually if teaching services are needed and both teaching and graduate work are satisfactory. Applications should be addressed to Professor Charles W. Roberts, Executive Secretary, 204a Lincoln Hall.

Graduate Teaching Faculty

Professors: G. N. Ray (Head of Department), T. W. Baldwin, J. T. Flanagan, H. F. Fletcher, R. A. Gettmann, M. T. Herrick, P. N. Landis, H. Larsen, J. J. Parry, C. W. Roberts, A. W. Secord, R. M. Smith, J. W. Beach (Visiting 1950-1951).

Associate Professors: S. E. Glenn, M. S. Goldman, J. N. Hook, B. A. Milligan, C. H. Shattuck.

Assistant Professors: G. B. Evans, A. G. Holaday, C. P. Kelley, E. G. Mathews, R. W. Rogers, G. B. Stillwell, L. C. Warren.

ENGLISH LITERATURE

Courses for Graduates

401. Old English (Anglo-Saxon). An introduction to the language before 1000 A.D. I; 1 unit. Smith.

402. Old English (Beowulf). II; 1 unit. Prerequisite: English 401. Smith.

403. History of the English Language. A study of the development of the language from the earliest stages to the present time. I; 1 unit. Smith.

411. Chaucer and His Times. A study of Chaucer and his contemporaries. The chief aim of this course is an intimate acquaintance with Chaucer's poetry and an appreciation of his art. I; 1 unit. Smith.

412. Chaucer and His Times. Continuation of English 411. II; 1 unit. Smith.

415. Middle English. Introduction to middle English dialects with special emphasis on the East Midland. II; 1 unit. Offered in 1950-1951 and in alternate years. Smith.

417. English Literature from the Norman Conquest to 1400. Primarily literature written in Latin and French (read in translation). I; 1 unit. Parry.

418. English Literature from the Norman Conquest to 1400. A survey of the literature, in all languages, produced in England during the period. II; 1 unit. Parry.

420. Medieval Latin (Anglo-Latin Writers). Study of the English writers of the Middle Ages who wrote in Latin; reading of selections in the original. II; 1 unit. Prerequisite: A reading knowledge of classical Latin. Parry.

421. Literature of the Sixteenth Century. I; 1 unit. Baldwin.

422. Literature of the Sixteenth Century. Continuation of English 421. II; 1 unit. Baldwin.

425. Seminar in Spenser. A study of special problems relating to the works of Edmund Spenser, his background in England and in Ireland, and the second half of the sixteenth century. I; 1 unit. Prerequisite: English 326 or any course in the sixteenth century. Offered in 1951-1952 and in alternate years. Smith.

427. Development of Tudor Drama. I; 1 unit. Offered in 1951-1952 and in alternate years. Baldwin.

428. Development of Tudor Drama. Continuation of English 427. II; 1 unit. Offered in 1951-1952 and in alternate years. Baldwin.

431. Shakespeare and Elizabethan Drama. I; 1 unit. Baldwin.

432. Shakespeare and Elizabethan Drama. Continuation of English 431. II; 1 unit. Prerequisite: English 431. Baldwin.

433. Seminar in Elizabethan Drama. II; 1 unit. Offered in 1950-1951 and in alternate years. Baldwin.

434. Elizabethan Drama. The immediate predecessors and early contemporaries of Shakespeare to 1603, exclusive of Shakespeare and Jonson. I; 1 unit. Offered in 1950-1951 and in alternate years. Baldwin.

435. Literature of the Seventeenth Century. I; 1 unit. Fletcher.

436. Literature of the Seventeenth Century. Continuation of English 435. II; 1 unit. Fletcher.

441. Seminar in Milton and His Age. I; 1 unit. Prerequisite: English 435 and 436; second-year graduate standing. Fletcher.

442. Seminar in Milton and His Age. Continuation of English 441. II; 1 unit. Prerequisite: English 435 and 436; second-year graduate standing. Fletcher.

445. Literature of the Eighteenth Century. I; 1 unit. Secord.

446. Literature of the Eighteenth Century. Continuation of English 445. II; 1 unit. Secord.

451. Studies in the History of the Eighteenth Century Novel. I; 1 unit. Secord.

452. Studies in the History of the Eighteenth Century Novel. Continuation of English 451. II; 1 unit. Secord.

455. Seminar in the History and Theory of Prose Fiction. I; 1 unit. Gettmann.

456. Seminar in the History and Theory of Prose Fiction. Continuation of English 455. II; 1 unit. Prerequisite: Second-year graduate standing. Gettmann.

459. The Romantic Movement. I; 1 unit. Gettmann.

460. The Romantic Movement. Continuation of English 459. II; 1 unit. Gettmann.

463. Victorian Literature. I; 1 unit. Ray.

464. Seminar in Victorian Literature. II; 1 unit. Prerequisite: English 463. Beach, Ray.

475. Studies in Bibliographical Method. Work on individual bibliographical problems, with a study of bookmaking, manuscripts and their relation to the printed text, editorial problems, and literary forgeries. II; 1 unit. Evans.

491. Research in Special Topics (Thesis). Guidance in writing theses for advanced degrees. I; 1 or 2 units. Baldwin, Beach, Evans, Fletcher, Gettmann, Goldman, Herrick, Holaday, Hook, Landis, Larsen, Mathews, Milligan, Parry, Ray, Roberts, Rogers, Secord, Smith, Stillwell, Warren.

492. Research in Special Topics (Thesis). Guidance in writing theses for advanced degrees. II; 1 or 2 units. Baldwin, Beach, Evans, Fletcher, Gettmann, Goldman, Herrick, Holaday, Hook, Landis, Larsen, Mathews, Milligan, Parry, Ray, Roberts, Rogers, Secord, Smith, Stillwell, Warren.

Courses for Graduates and Advanced Undergraduates

311. Chaucer. I; ½ to 1 unit. Stillwell.

313. Introduction to the Literature of the Middle Ages. The literature of western Europe from 1000 to 1500. The literary background, and the literature of the castle. I; ½ to 1 unit. Parry.

314. Introduction to the Literature of the Middle Ages. The literature of western Europe from 1000 to 1500. Lyric poetry; the literature of the cloister and the tavern. II; ½ to 1 unit. Parry.

325. English Literature from 1588 to 1660. II; ½ to 1 unit. Milligan.

326. Spenser. II; ½ to 1 unit. Goldman.

336. English Drama Exclusive of Shakespeare. From 1600 to 1700. II; ½ to 1 unit. Herrick.

337. Problems in Shakespeare. Nine plays. Special attention will be given to the modern critical approach and to the principal Shakespearean critics. Prerequisite: English 131, or equivalent; consent of instructor. S; ½ to 1 unit. Evans.

338. Tragedy. Comparative study of masterpieces in several periods of Western culture. Major emphasis will be on Ancient Greek and Roman, and English Elizabethan and Stuart drama. II; ½ to 1 unit. Warren.

342. The Poetry of Milton. Origins, forms, artistic and ethical values; Milton's place in English literary history. II; ½ to 1 unit. Fletcher.

346. The Age of Dryden. I; ½ to 1 unit. Evans.

347. Alexander Pope. Pope's prose and poetry together with selections from Pope's classical models (in translation). II; ½ to 1 unit. Rogers.

351. The Mid-Victorian Novel. Thackeray, Charlotte Brontë, Mrs. Gaskell, Dickens, George Eliot, Trollope. II; ½ to 1 unit. Ray.

355. Survey of English Literature. From the beginning to 1700. I; ½ to 1 unit. Holaday, Milligan, Parry, Rogers.

356. Survey of English Literature. From 1700 to 1900. II; ½ to 1 unit. Holaday, Milligan, Parry, Rogers.

363. Introduction to Comparative Literature. Same as German 363. A com-

parative study of great books in Greek, Roman, Italian, and Spanish literature. I; ½ unit. HAMILTON, LANDIS, VAN HORNE.

364. INTRODUCTION TO COMPARATIVE LITERATURE. Same as German 364. A comparative study of great books in French, German, and English literature. II; ½ unit. JACOB, LANDIS, REHDER.

371. HISTORY AND PRINCIPLES OF LITERARY AND RHETORICAL CRITICISM: ARISTOTLE TO SIDNEY. Same as Speech 371. I; ½ to 1 unit. HERRICK.

372. HISTORY AND PRINCIPLES OF LITERARY AND RHETORICAL CRITICISM: SIDNEY TO THE PRESENT. Same as Speech 372. II; ½ to 1 unit. HERRICK.

AMERICAN LITERATURE

Courses for Graduates

439. PROBLEMS IN AMERICAN LITERATURE AND CULTURAL HISTORY. A conference and research course devoted to intensive studies in the relation of selected writers and problems in American literature, to critical movements. I; 1 unit. Prerequisite: At least a survey of American literature, or consent of instructor. FLANAGAN.

440. PROBLEMS IN AMERICAN LITERATURE AND CULTURAL HISTORY. Continuation of English 439. II; 1 unit. Prerequisite: At least a survey of American literature, or consent of instructor. FLANAGAN.

491. RESEARCH IN SPECIAL TOPICS (THESIS). Guidance in writing theses for advanced degrees. I; 1 to 2 units. FLANAGAN, GLENN, KELLEY.

492. RESEARCH IN SPECIAL TOPICS (THESIS). Guidance in writing theses for advanced degrees. II; 1 to 2 units. FLANAGAN, GLENN, KELLEY.

Courses for Graduates and Advanced Undergraduates

315. THE AMERICAN DRAMA. An historical survey of the American drama from the beginning to Clyde Fitch, including the reading of a large number of representative plays. I; 1 unit. Offered in 1951-1952 and in alternate years. FLANAGAN.

316. THE AMERICAN DRAMA. An historical survey of the American drama from Clyde Fitch to the present, including the reading of a large number of representative plays. II; 1 unit. Offered in 1951-1952 and in alternate years. FLANAGAN.

318. THE AMERICAN NOVEL: COOPER TO NORRIS. Cooper, Hawthorne, Melville, James, Twain, Howells, Norris, Glasgow. S; ½ to 1 unit.

353. STUDIES IN MIDDLE WESTERN LITERATURE. A survey of Middle Western literature from about 1825 to Dreiser, with special emphasis on the development of realism in poetry and fiction. I; 1 unit. Prerequisite: English 113 or 114, or one course in American history. Offered in 1950-1951 and in alternate years. FLANAGAN.

354. STUDIES IN MIDDLE WESTERN LITERATURE. A survey of Middle Western literature from Dreiser to the present, with special emphasis on the development of realism in poetry and fiction. II; 1 unit. Prerequisite: English 113 or 114, or one course in American history. Offered in 1950-1951 and in alternate years. FLANAGAN.

373. TWENTIETH CENTURY AMERICAN POETRY. Investigation of the ideas and

methods of representative British and American poets from 1920 to the present day. II; ½ to 1 unit. Prerequisite: Six hours of English literature. BEACH.

375. HENRY JAMES AND THE TECHNIQUE OF FICTION. A study of the development of Henry James as a novelist, of influences upon him, and of his influence on novelists of the twentieth century, chiefly American. I; ½ to 1 unit. Prerequisite: Consent of instructor. KELLEY.

381. THE TWENTIETH CENTURY AMERICAN NOVEL. Dreiser, Fitzgerald, James, Hemingway, Lewis, Anderson, Dos Passos, Wolfe, Faulkner, and Steinbeck. I; ½ to 1 unit. BEACH.

RHETORIC AND COMPOSITION

Courses for Graduates

480. THE THEORY AND PRACTICE OF ENGLISH COMPOSITION. An examination of modern prose style and a consideration of problems confronting writers and teachers of writing at the college level. I, II; 1 unit. Prerequisite: Consent of instructor. ROBERTS.

491. RESEARCH IN SPECIAL TOPICS (THESIS). Guidance in writing theses for advanced degrees. I; 1 unit. ROBERTS.

492. RESEARCH IN SPECIAL TOPICS (THESIS). Guidance in writing theses for advanced degrees. II; 1 unit. ROBERTS.

ENTOMOLOGY

The Department of Entomology offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy. A prerequisite for graduate work in entomology is a grade-point average of at least 3.5 during the last two years of undergraduate training, exclusive of required military training and physical education. Students are not admitted on limited status. In addition, two years of undergraduate work in biology including zoology and entomology are required. A candidate who chooses entomology as a major for an advanced degree must have had at least six hours of undergraduate credit in entomology. A reading knowledge of either French or German is required by the beginning of the second year of graduate study.

The following fields are available for specialization within the department: insect bionomics and ecology, insect morphology and embryology, economic entomology, medical and veterinary entomology, insecticides, insect taxonomy, insect toxicology, and insect physiology. The department is well equipped to offer work in these areas and the facilities of the State Natural History Survey are also available for advanced study. Outstanding entomological library facilities are located on the campus.

Minor work may be elected in agronomy, bacteriology, botany (including plant pathology), chemistry, horticulture, physiology, or zoology. The various prerequisites for advanced courses in the minor field must be met.

Candidates for the master's degree must write a thesis and pass an oral examination covering the general field of entomology. At the option of the faculty, a written examination may also be required.

Candidates for the degree of Doctor of Philosophy in Entomology must pass examinations in two foreign languages and the usual oral preliminary examination before entering the last year of residence. At the preliminary examination a can-

didate must exhibit a broad background in the whole field of entomology and a knowledge of general biological principles. Candidates should pursue a course of independent private study to include such fields as the history of biology, zoology, and entomology; the philosophy of science; biological literature and biological statistics.

Theses required for the master's and doctor's degrees are due in the office of the Department of Entomology ten days before they are due in the office of the Graduate College. During this ten-day period theses are available for reading and correcting by faculty members in order that suggested changes may be made in them before they are delivered to the Dean of the Graduate College.

Fellowships and Assistantships

One industrial research fellowship, granting full-time residence with a stipend of $1,500 for eleven months, has been established by Swift and Company for research in the field of insect nutrition.

One industrial research fellowship, granting full-time residence with a stipend of $1,500 for eleven months, has been established by the Gulf Oil Development Company for study of the mode of action of synergists on pyrethrum.

The United States Public Health Service has established a fellowship granting full-time residence and exemption from fees with a stipend of $1,500 for eleven months. It has been provided for research in the field of insect physiology.

For information concerning industrial fellowships write the Head of the Department of Entomology.

Four half-time teaching assistantships are available in the Department with a stipend of $1,200 and exemption from fees.

In the Division of Economic Entomology of the Illinois State Natural History Survey and the College of Agriculture, one half-time industrial research assistantship has been established by the Standard Oil Company of Indiana for the study of oil insecticides. This carries a stipend of $1,500 and fee exemption for an eleven-month's appointment.

Three half-time special research assistantships are available in the Division of Economic Entomology of the Illinois State Natural History Survey for control studies of economic insects. These carry stipends up to $2,000 and fee exemption.

For information concerning assistantships in the Illinois State Natural History Survey write Professor George C. Decker, 123 Natural Resources Building, Urbana, Illinois. For information concerning other assistantships write the Head of the Department of Entomology.

Graduate Teaching Faculty

Professors: W. P. Hayes (Head of Department), W. V. Balduf, G. C. Decker, G. S. Fraenkel, C. W. Kearns, H. H. Ross.

Associate Professor: V. G. Milum.

Assistant Professor: W. R. Horsfall.

Courses for Graduates

407. External Insect Anatomy. A comparative study of the external anatomy of various orders of insects. I; 1 unit. Offered in 1950-1951 and in alternate years. Hayes.

408. Internal Insect Anatomy. A comparative study of the internal anatomy of various orders of insects. II; 1 unit. Prerequisite: Entomology 407. Offered in 1950-1951 and in alternate years. Hayes.

425. Seminar in Entomology. I; ¼ unit.

426. Seminar in Entomology. II; ¼ unit.

493. Research. Work may be taken in the following subjects: (a) morphology and embryology of insects, (b) economic entomology, (c) systematic entomology, (d) biology and ecology of insects, (e) insect physiology. I; ½ to 4 units. Balduf, Decker, Fraenkel, Hayes, Horsfall, Kearns, Milum, Ross.

494. Research. Work may be taken in the following subjects: (a) morphology and embryology of insects, (b) economic entomology, (c) systematic entomology, (d) biology and ecology of insects, (e) insect physiology. II; ½ to 4 units. Balduf, Decker, Fraenkel, Hayes, Horsfall, Kearns, Milum, Ross.

Courses for Graduates and Advanced Undergraduates

306. Special Problems. For students ready to take up some special investigation which may be completed as an undergraduate study or the beginning of a thesis problem for an advanced degree. It may also be used to prepare a thesis for scholastic honors. I, II; ¼ to 1 unit. Prerequisite: Any of the following: Entomology 131, 308, 309, 310, 313, 317, 318, 319, 320, 322, 323, 324, or Zoology 101 or 321. Balduf, Decker, Fraenkel, Hayes, Horsfall, Kearns, Milum, Ross.

308. Insect Pests of Field Crops. II; ½ unit. Prerequisite: Entomology 101. Offered in 1950-1951 and in alternate years. Hayes.

309. Morphology and Taxonomy of Immature Insects. A study of the structures of nymphs, larvae, and pupae. This course is devoted to morphological studies which are followed by taxonomic studies in Entomology 310. I; ½ unit. Prerequisite: Consent of instructor. Offered in 1951-1952 and in alternate years. Hayes.

310. Morphology and Taxonomy of Immature Insects. A study of the taxonomy of nymphs, larvae, and pupae. A sequence to Entomology 309. II; ½ unit. Prerequisite: Entomology 309. Offered in 1951-1952 and in alternate years. Hayes.

312. Entomology for Teachers. Recognition of the chief orders of insects in their immature and adult stages, how they develop, life cycles, food, habitats, adaptations for feeding, oviposition, movement, protection, defense, making sound and other functions, interrelations with other organisms, environment, and social life. A collection of insects will be identified, mounted, and labeled. Field trips, laboratory, and discussions. S; ½ unit. Prerequisite: One year of biology, botany, zoology, or equivalent. Offered in 1951 and every third year thereafter. Balduf.

313. Medical and Veterinary Entomology. Training in recognition, classification, methods of injury, habits, and control or destruction of insects, mites, and ticks which are predators, parasites, or disseminators of diseases among men and domestic animals. I; ½ or 1 unit. Prerequisite: Entomology 101 and 102, or 103, or Zoology 320. Horsfall.

316. Advanced Economic Entomology. A consideration of the principles underlying ways and means of preventing injury to crops and various products. II; ½ unit. Prerequisite: Entomology 101 or 103. Offered in 1950-1951 and in alternate years. Horsfall.

317. Classification of Insects. Orders with gradual metamorphosis, and principles of systematic entomology. The distinctive structural features of the orders comprising the Ametabola and Heterometabola; comparison of various systems of classification of the orders; how to recognize the more common families; practice in keying to species. The principles embrace sources of material, segregation, preparation of keys, descriptions, bibliographies, and outlines for revisional papers. I; 1 unit. Prerequisite: Entomology 101 or 103, or equivalent. Offered in 1950-1951 and in alternate years. Balduf.

318. Classification of Insects. Orders with complete metamorphosis and principles of systematic entomology. Distinctive structural features of the orders comprising the subclass Holometabola; comparison of the various systems of classification of the orders; how to recognize the more common families; practice in keying to species; literature; biographies. II; 1 unit. Prerequisite: Entomology 101 or 103, or equivalent. Offered in 1950-1951 and in alternate years. Balduf.

319. Chemical Control of Insects. Discussion and actual practice in the most effective control measures for insect pests; training for professional or commercial work as an entomologist, pest control supervisor, or agricultural agent. II; 1 unit. Prerequisite: Entomology 101 or 103, or a course in economic entomology. Kearns.

320. Chemistry and Toxicology of Insecticides. Designed to provide the fundamental information available concerning the mode of action, the relationship of chemical structure to toxicity, and the physiological explanation of the chemical poisoning of insects. I; ½ unit. Prerequisite: One year of biology, or equivalent in animal sciences; a course in organic chemistry. Kearns.

322. Insect Bionomics. This phase of the biology of insects deals with life history and conditions of environment that favor abundance of insects representative of various habitats. II; ½ unit. Prerequisite: Entomology 101 and 102, or 103, or Zoology 320. Offered in 1951-1952 and in alternate years. Horsfall.

323. Insect Physiology. I; 1 unit. Prerequisite: A course in organic chemistry; consent of instructor. Fraenkel.

324. Insect Physiology. II; 1 unit. Prerequisite: A course in organic chemistry; consent of instructor. Fraenkel.

FOOD TECHNOLOGY

(Including Dairy Technology)

The Department of Food Technology offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy in both Food Technology and Dairy Technology.

Students undertaking graduate work in either dairy or food technology must have a grade-point average of at least 3.5 in the final two years of undergraduate work, exclusive of required physical education and military training. Students admitted on a grade-point average below 3.75 will be accepted only under the condition that their records will be subject to departmental review after they have completed four units of work and that determination of their acceptability to continue on an advanced degree program will be made at that time.

A student planning to take a major or minor in dairy technology should

have had previous training as an undergraduate in this field. It is also desirable for the student to have had a course in statistics, advanced undergraduate training in mathematics and chemistry, and at least a year of French or German.

Minors may be selected from the following fields of study: economics, agricultural economics, business organization and operation, chemistry, bacteriology, physics, nutrition, veterinary medicine, and dairy production. Requirements for the minors will be established by the respective departments concerned.

To obtain a master's degree in dairy technology, a student must have credit in Chemistry 350, Dairy Technology 401 (one unit), 404 (one unit), and 493-494 (two units). A course in statistics is also necessary unless such a course was taken by the student when an undergraduate. The remainder of the eight units required for the Master of Science degree can be taken in the major and minor fields.

Candidates for the degree of Doctor of Philosophy in Dairy Technology should complete the requirements for their minors by the end of the second year of residence so that the last year can be spent in research on their thesis problems (Dairy Technology 493 and 494). Each candidate will be required to pass a written examination at the end of the second year of residence but before the oral preliminary examination for the doctorate.

Second-year and third-year graduate students are expected to attend all seminars (Dairy Technology 404) in dairy technology, but they can register for a maximum of only one unit of credit.

A student planning to take a major or minor in food technology should have a Bachelor of Science degree in food technology or in a major field of chemistry, bacteriology, chemical engineering, horticulture, or other recognized field of biological, physical, agricultural, or engineering science in which a minimum of the undergraduate credits are as follows: college biology, six hours; college physics, eight hours; calculus, six hours; bacteriology, five hours; analytical chemistry, five hours; organic chemistry, five hours; physical chemistry, four hours; and food technology or equivalent, twenty hours. Deficiencies in any of these requirements may be made up during the first year of graduate study, but no graduate credit will be given.

To obtain a graduate degree in food technology, a student must have credit (graduate or undergraduate) in Bacteriology 308, Chemistry 329 and 350, and Food Technology 301, 302, 332, 421-422 (M.S., one-half unit; Ph.D., one unit), and 493-494 (M.S., two units; Ph.D., eight units). Minors may be selected from the fields of physical, biological, agricultural, or engineering science, and must be approved by the Department.

Candidates for the master's degree must complete one language requirement (German, French, or Spanish) and one minor (minimum one unit) and will be required to take an examination covering the field of general food technology and of their specialization. This will be primarily an oral examination although, at the option of the faculty, it may include a written section. A thesis is required and must be in the office of the Department of Food Technology ten days before it is due in the Graduate College office.

Candidates for the degree of Doctor of Philosophy in Food Technology must complete two language requirements (German and French or Spanish) and must have at least one minor subject. If a sole minor, a minimum of four units must be earned or, if accompanied by a second minor, a minimum of two units in each minor. The formal course work should be completed by the end of the second year in residence so that the last year can be spent in research on the thesis problem. A comprehensive written qualifying examination covering the general field of food technology and the minor fields of study will be given after the student has completed sixteen units of graduate work and has satisfied the two language requirements. The results of this examination will serve the adviser as

a guide in determining the student's readiness to appear for the preliminary oral examination. The thesis must be in the office of the Department of Food Technology ten days before it is due in the Graduate College office.

Graduate credit courses offered outside the Department of Food Technology may be applied in partial satisfaction of the major unit requirements. These may be selected from closely related fields of study, such as bacteriology, chemistry, physics, engineering, and applied biological sciences, and are subject to the approval of the major department.

Graduate Teaching Faculty

Professors: L. B. Howard (Head of Department), E. O. Herreid, P. H. Tracy.

Associate Professors: A. I. Nelson, Z. J. Ordal, S. L. Tuckey, R. M. Whitney.

FOOD TECHNOLOGY

Courses for Graduates

421. Seminar. Discussions on specialized topics and current literature relating to food technology. Required of all graduate students in food technology. I; ½ unit. Howard, Nelson, Ordal.

422. Seminar. Discussions on specialized topics and current literature relating to food technology. Required of all graduate students in food technology. II; ½ unit. Howard, Nelson, Ordal.

481. Advanced Studies in Food Technology. Library or laboratory assignments on specific problems of limited scope involving individual commodities or processes. I; ½ to 2 units. Howard, Nelson, Ordal.

482. Advanced Studies in Food Technology. Library or laboratory assignments on specific problems of limited scope involving individual commodities or processes. II; ½ to 2 units. Howard, Nelson, Ordal.

493. Research. I; ½ to 4 units. Howard, Nelson, Ordal.

494. Research. II; ½ to 4 units. Howard, Nelson, Ordal.

Courses for Graduates and Advanced Undergraduates

301. Food Processing. Lectures, discussions, and pilot-plant demonstrations and experiments in preservation of foods by canning, freezing, dehydrating, and fermenting methods. Evaluation of product quality by subjective and objective methods and consideration of factory quality control factors. Field trips to commercial food plants. I; 1 unit. Prerequisite: Food Technology 201, or equivalent. Nelson.

302. Food Processing. Lectures, discussions, and pilot-plant demonstrations and experiments in food manufacture including formulation of food preparations from fruits, vegetables, and cereals; preservation of meats, fish, and poultry products; and extraction and refining of vegetable oils. Evaluation of product quality by subjective and objective methods and consideration of factory quality control factors. Field trips to commercial food plants. II; 1 unit. Prerequisite: Food Technology 202 and 301, or equivalent. Nelson.

332. Principles of Sanitation in the Processing and Handling of Foods. Same as Veterinary Pathology and Hygiene 332. A study of the principles of sanitation with appropriate emphasis on practical considerations as

they apply to various food processing industries. Control of insects, rodents, and microorganisms; fundamentals of detergency; sanitation of water supplies; waste disposal methods. Government and public health regulations. Local field trips to food processing plants. II; 1 unit. Prerequisite: Bacteriology 104 and 105, Chemistry 132, or equivalents. ORDAL.

363. UNIT OPERATIONS IN FOOD TECHNOLOGY. Same as Chemical Engineering 363. Fundamentals of heat transfer, fluid flow, extraction, drying, and other unit operations especially adapted to the food and biochemical industries. Primarily for students in chemistry and food technology; not open to majors in chemical engineering. Lectures and problems. I; ¾ unit. Prerequisite: Chemistry 240 or Chemistry 247 and one year of calculus. FINN.

373. ADVANCED FOOD MICROBIOLOGY. A study of the microbiology of those foods, food processes, or food ingredients, the production of which involves the biological or enzymatic activities of bacteria, yeasts, or the higher fungi. I; 1¼ units. Prerequisite: Bacteriology 308 and Chemistry 133, or equivalent. ORDAL.

DAIRY TECHNOLOGY

Courses for Graduates

401. ADVANCED PRINCIPLES OF DAIRY TECHNOLOGY. Study of fundamental problems involved in the processing of milk and milk products. I; 1 unit. HERREID.

404. SEMINAR. Review of current literature in dairy technology. Students may register for credit only twice for a maximum of one unit. I, II; 0 to ½ unit.

491. ASSIGNED PROBLEMS IN DAIRY TECHNOLOGY. Research on special problems for graduate students with a major interest in dairy technology. I; ½ to 2 units. HERREID, TRACY, TUCKEY, WHITNEY.

492. ASSIGNED PROBLEMS IN DAIRY TECHNOLOGY. Research on special problems for graduate students with a major interest in dairy technology. II; ½ to 2 units. HERREID, TRACY, TUCKEY, WHITNEY.

493. THESIS. I; ½ to 4 units. HERREID, ORDAL, TRACY, TUCKEY, WHITNEY.

494. THESIS. II; ½ to 4 units. HERREID, ORDAL, TRACY, TUCKEY, WHITNEY.

Courses for Graduates and Advanced Undergraduates

301. ICE CREAM MANUFACTURE. Technical problems and methods involved in the manufacture of commercial ice cream, sherbets, and ices. I; ½ unit. Prerequisite: Dairy Science 150 and 151; Dairy Technology 101. TOBIAS, TRACY.

302. CREAMERY BUTTER MANUFACTURE. Preparation of cream, churning, and packaging of butter. II; ½ unit. Prerequisite: Dairy Science 150 and 151; Dairy Technology 101. TUCKEY.

303. CHEESE MANUFACTURE. Manufacture and ripening procedures for domestic and foreign types of cheese. I; ½ unit. Prerequisite: Dairy Science 150 and 151; Dairy Technology 101. TUCKEY.

304. MARKET MILK. Production, quality control, assembling, and processing of fluid milk and related products. II; ½ unit. Prerequisite: Dairy Science 150 and 151; Dairy Technology 101. HERREID.

306. CONDENSED MILK AND MILK POWDER MANUFACTURE. Methods of manufac-

turing different types of condensed and dried milks. II; ½ unit. Prerequisite: Dairy Science 150 and 151; Dairy Technology 101. TOBIAS, TRACY.

308. PLANT MANAGEMENT. Problems in the organization, financing, labor management, and operation of dairy plants. II; ½ unit. TRACY.

FRENCH

The Department of French offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy.

Students with a minimum grade-point average of 3.5 or above in the last two years of undergraduate work, exclusive of required courses in physical education and military training, are regularly admitted to graduate courses in French, subject to fulfillment of other prerequisites. Students on limited status may be accepted according to the individual case.

Students electing French as a major subject should have had the equivalent of at least four years of French in college, including practical work in the use of the language and an advanced course in literature. Some knowledge of other Romance languages and literatures is desirable. A basic knowledge of Latin and a reading competence in German are required for the doctorate.

Students choosing French as a minor subject will be admitted to courses for which they are adequately prepared.

Degree of Master of Arts in French. In addition to fulfilling the general requirements of the Graduate College, candidates for the degree of Master of Arts in French must pass an examination based on a general reading list. Candidates preparing to teach French will take French 409 and 410, unless they can demonstrate proficiency.

Degree of Doctor of Philosophy in French. Candidates for this degree are required to include French 475 and 476, for which some knowledge of Latin is essential. These courses may be counted as the field of a first minor subject.

Degree of Master of Arts in the Teaching of French. Candidates for the degree of Master of Arts in the Teaching of French must earn four units in French, two units in education, and two units in electives. Requirements are French 409 and 410, two units; two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit. The elective courses in French and the other electives must be selected with the approval of the adviser. The electives may be in French, in education, or, in exceptional cases, in other fields. The grade-point average is the same as that required by the Department for admission. Students on limited status will not be admitted. The adviser for candidates for this degree is Professor J. F. Jackson, 230 Lincoln Hall.

Assistantships

A limited number of teaching assistantships are generally available. These are ordinarily on a part-time basis, providing a distribution of work between teaching and study. Applications for assistantships should be addressed to the Head of the Department.

Graduate Teaching Faculty

Professors: J. F. JACKSON (Head of Department), C. A. KNUDSON.

Associate Professors: C. C. GULLETTE, P. E. JACOB, J. R. SMILEY.

Assistant Professors: P. KOLB, C. P. VIENS.

Courses for Graduates

400. Beginning French for Graduate Students. Basic grammar and vocabulary; reading practice. Designed for graduate students desiring help in preparing for the French reading requirements for the Ph.D. degree. I, II; no graduate credit.

401. Reading French for Graduate Students. Grammar, vocabulary, general and special reading. Designed for graduate students desiring help in preparing for the French reading requirements for the Ph.D. degree. I, II; no graduate credit. Prerequisite: French 400, or French 101 and 102, or equivalent.

409. The Phonetics of French. A descriptive study of the sounds of French, with exercises for the improvement of pronunciation and diction. Conducted in French. I; 1 unit. Knudson.

410. Advanced Syntax. An advanced theoretical and practical study of present-day French, with some consideration of stylistics. Conducted in French. II; 1 unit. Knudson.

431. Old French Literature. Reading of characteristic selections from the eleventh to the fifteenth centuries, and study of the literary history of the period, with particular emphasis on epic and romance. I; 1 unit. Knudson.

432. Old French Literature. Reading of characteristic selections from the eleventh to the fifteenth centuries, and study of the literary history of the period, with particular emphasis on epic and romance. II; 1 unit. Knudson.

433. Villon, Rabelais, Montaigne, La Pléiade. I; 1 unit.

434. Villon, Rabelais, Montaigne, La Pléiade. II; 1 unit.

435. Seventeenth Century Literature. I; 1 unit.

436. Seventeenth Century Literature. II; 1 unit.

437. Eighteenth Century Literature. I; 1 unit. Smiley.

438. Eighteenth Century Literature. II; 1 unit. Smiley.

447. Nineteenth Century Literature to 1850. I; 1 unit. Jackson.

448. Nineteenth Century Literature to 1850. II; 1 unit. Jackson.

453. French Realism and Naturalism. I; 1 unit. Jackson.

454. French Realism and Naturalism. II; 1 unit. Jackson.

465. La Littérature Contemporaine. In French. Poetry: Baudelaire. Symbolism up to Valéry. Prose writers from 1900 to 1940. I; 1 unit. Jacob.

466. La Littérature Contemporaine. In French. Poetry: Baudelaire. Symbolism up to Valéry. Prose writers from 1900 to 1940. II; 1 unit. Jacob.

475. History of the French Language. External history: development of the language in its historical setting. Internal history: the development of sounds, forms, vocabulary, and syntax from spoken Latin to modern French. I; 1 unit. Prerequisite: An elementary knowledge of Latin. Knudson.

476. History of the French Language. External history: development of the language in its historical setting. Internal history: the development of sounds, forms, vocabulary, and syntax, from spoken Latin to modern French. II; 1 unit. Prerequisite: An elementary knowledge of Latin. Knudson.

491. Research and Thesis. I; 1 to 4 units. Jackson, Jacob, Knudson, Smiley.

492. Research and Thesis. II; 1 to 4 units. Jackson, Jacob, Knudson, Smiley.

Courses for Graduates and Advanced Undergraduates

309. Survey of French Literature. I; ½ unit. Prerequisite: French 202, or equivalent; consent of instructor. Jackson.

310. Survey of French Literature. II; ½ unit. Prerequisite: French 202, or equivalent; consent of instructor. Jackson.

317. Modern French Drama. I; ½ unit. Prerequisite: French 202, or equivalent; consent of instructor. Viens.

318. Modern French Drama. II; ½ unit. Prerequisite: French 202, or equivalent; consent of instructor. Viens.

323. French Drama of the Seventeenth and Eighteenth Centuries. I; ½ unit. Prerequisite: French 202, or equivalent; consent of instructor. Kolb.

324. French Drama of the Seventeenth and Eighteenth Centuries. II; ½ unit. Prerequisite: French 202, or equivalent; consent of instructor. Kolb.

331. French Novel of the Nineteenth Century. From Balzac to Proust. I; ½ unit. Prerequisite: French 201 and 202. Jacob.

332. French Novel of the Nineteenth Century. From Balzac to Proust. II; ½ unit. Prerequisite: French 201 and 202. Jacob.

333. La Littérature Contemporaine. In French. Modern poetry from Baudelaire to Valéry. Prose writers from 1900 to 1940. I; ½ unit. Prerequisite: French 201 and 202. Offered in 1951-1952 and in alternate years. Jacob.

334. La Littérature Contemporaine. In French. Modern poetry from Baudelaire to Valéry. Prose writers from 1900 to 1940. II; ½ unit. Prerequisite: French 201 and 202. Offered in 1951-1952 and in alternate years. Jacob.

335. Civilisation Française. In French. I; ½ unit. Prerequisite: French 202, or equivalent; consent of instructor. Offered in 1950-1951 and in alternate years. Jackson.

336. Civilisation Française. In French. II; ½ unit. Prerequisite: French 202, or equivalent; consent of instructor. Offered in 1950-1951 and in alternate years. Jackson.

GENETICS

Those desiring a general training in genetics may take a major or minor in botany or zoology. Those desiring to approach agricultural problems through genetics may take a major or minor in agronomy, horticulture, animal science, or dairy science. For courses in the subject see departments of Agronomy, Animal Science, Botany, Dairy Science, Horticulture, and Zoology. An interdepartmental genetics seminar is held at 4 p.m. on the second, third, and fourth Mondays, in 107 Animal Genetics Building.

GEOGRAPHY

The Department of Geography offers graduate work leading to the degrees of Master of Arts, Master of Science, and Doctor of Philosophy. The following fields of geography are available for specialization in graduate study: climatology, economic geography, cartography, land utilization, conservation of resources, regional geography, political geography, and educational geography.

Students applying for admission must have a 3.5 grade-point average for that portion of the work which represents the last fifty per cent of the hours earned toward the bachelor's degree, exclusive of required courses in physical education and military training. Students on limited status will not be admitted. All candidates for advanced degrees in geography must have an average of at least B in previous work in geography. Candidates for the Ph.D. have full departmental status if they have completed work essentially equivalent to that required for the master's degree by the Department, if their previous graduate record is well above B and if their qualifications promise superior ability. All others will be placed in provisional departmental status and must demonstrate their ability to carry graduate study during their first semester in residence.

Degree of Master of Arts or Master of Science. Successful candidates for the master's degree whose background is largely in physical geography will be recommended for the degree of Master of Science; others will receive the degree of Master of Arts. The program leading to the master's degree in geography is to add breadth to the student's geographic knowledge and to introduce the student to semi-independent accumulation and use of the geographic materials in seminars, and to independent research and advanced study. Adequate latitude in course requirements is provided to allow the candidate to complete his understanding of the broad aspects of geography (depending on his undergraduate concentration) and to begin to penetrate more deeply into specific phases of geographic content. In this way the master's degree can be either a terminal degree, or it can lead directly into the more intensive study toward the doctorate.

Entering master's candidates are expected to offer at least eighteen hours of undergraduate work in geography in addition to a beginning course; those offering less than this amount must correct this deficiency without graduate credit. At least four of the minimum of eight units of graduate credit required for the master's degree will be in geography, and all eight may be in geography. In individual cases, additional units of work may be required by the Departmental Graduate Committee. Students must have had, either as an undergraduate or as a graduate, training in climatology, map construction and map reading and interpretation, introductory field work, economic geography, and regional geography. They must also have proficiency equivalent to that expected of an Illinois undergraduate major in a physical or biological science, in a social science, in statistical method, and in oral and written expression. Geology, botany, soils, or zoology are recommended as sciences; economics, history, political science, sociology, or anthropology are recommended in the social sciences. Candidates for the master's degree may use one and one-half units of graduate credit to correct content deficiencies in these divisions of geography and cognate fields.

All candidates for the degree of Master of Science or Master of Arts in Geography must take Geography 477; two of the following graduate seminars: Geography 412, 421, 461, and 497; and at least one-half unit of independent advanced study (Geography 495 or 496). Students are advised to enroll in Geography 473 and 478 during their master's program, although these courses are not degree requirements. A master's thesis is usually required, but the Department may waive the thesis in certain circumstances.

Degree of Master of Science in the Teaching of Geography. Candidates for this degree must earn four units in geography, two of which are electives, two units in education, and two units in electives. Requirements are Geography 493 and/or 494, one unit; Geography 495 and/or 496, one unit; two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit. The elective courses in geography and the other electives must

be selected with the approval of the adviser. Two electives must be in geography, and the other two in geography, in education, or, in exceptional cases, in other fields. The grade-point average required for admission is the same as required by the Department. No limited status students will be admitted to this program. The adviser for candidates for this degree is Professor J. H. Garland, 248 Natural History Building.

Degree of Doctor of Philosophy. The doctoral program presupposes an understanding of geographic patterns. This program is, therefore, intended to increase the student's ability to use his knowledge of geography and its allied fields, and to provide maximum opportunity for the exercise of independent ability. The doctoral student will be encouraged to penetrate deeply into the content, techniques, implications, and significance of specific phases of geographic study, including one physical systematic field, one cultural systematic field, and one major region of the world.

Candidates for the degree of Doctor of Philosophy in Geography must have taken, either as an undergraduate or as a graduate, all work or the equivalent, which is required in the undergraduate major, master's and doctor's program of the Department. Not more than one and one-half units of credit beyond the eight units required for the Illinois master's degree may be in areas specifically required in the undergraduate major or master's curriculum. Eight of the minimum twenty-four units of graduate credit required for the Ph.D. will be in Geography 493 and 494, and will be devoted to the completion of an original and independent doctoral thesis. Geography 493 and 494 will be carried subsequent to the admission of the student to candidacy for the degree.

The work required for a Ph.D. in geography is divided into two phases, first that of preparing a student for formal admission to candidacy for the degree, and second, the satisfactory completion of the doctor's thesis and the support of the thesis in an examination.

Admission to candidacy for the Ph.D in geography will be recommended after the successful completion of the following requirements:

(1) At least sixteen units of graduate credit, or their equivalent, including four units in official minor fields. At least nine of these sixteen units must be in geography, including Geography 477, 421, 497, 473, 478, 495 or 496, and either Geography 412 or 461. Equivalent work taken elsewhere will be accepted subject to examination. The Department recommends a split minor, consisting of at least two units in each field. One of the minors should be in geology, botany, soils, or zoology, the other in economics, history, political science, or sociology and anthropology. Other minor fields may be accepted upon recommendation of the major adviser.

(2) The required examinations in foreign languages.

(3) A preliminary examination, which will be administered by a committee appointed by the Dean of the Graduate College. The examination will cover selected divisions of physical, cultural, and regional geography, the techniques and theory of the discipline, and the student's minor fields.

After being admitted to candidacy for the Ph.D., the student must complete a research thesis which demonstrates his capacity to complete and to support independent and original work in geography. The doctoral thesis will normally require field investigation.

Additional information concerning the requirements of the Department may be obtained from the Head of the Department.

Assistantships

Teaching assistantships are available in geography. Only students who present records above the minimum requirements for full departmental admission

will be considered for assistantships. Application for assistantships should be made to J. A. Russell, Department of Geography, 249 Natural History Building.

Graduate Teaching Faculty

Professors: J. A. Russell (Head of Department), W. O. Blanchard, J. L. Page (on leave first semester 1950-1951).

Associate Professors: A. W. Booth, F. W. Foster, J. H. Garland.

Courses for Graduates

412. Analytical Climatology. A detailed consideration of the character and causes of the climates of certain selected areas. The application of various criteria as bases for climatic differentiation. I; 1 unit. Prerequisite: Geography 111; Geography 313, or equivalent; consent of instructor. Page.

421. Regional Concepts in Geography. Theories of regionalism, nature of the geographic region, the unique position of regionalism in a total geographic philosophy. Regionalism in applied geography. II; ½ unit. Prerequisite: Nine hours of regional geography. Garland.

461. Formulation of Principles of Economic Geography. Discussions organized around topics which establish underlying principles of the distribution of economic activity. I; ½ unit. Blanchard, Russell.

473. Problems in Cartography. Subjects for map presentation are selected in the student's field of specialization or area of interest. Data are collected and maps compiled and carried to completion in final drafted form suitable for publication. II; 1 unit. Prerequisite: Geography 373, or consent of instructor. Foster.

477. Area Analysis. Individual analysis of areas in the vicinity of Urbana. I; 1 unit. Foster.

478. Advanced Field Geography. A graduate course in the theory and application of geographical field techniques to the analysis of areas, culminating in individual reports on assigned problems in the field course area. S; 1¼ to 2 units. Staff.

493. Research. I; ½ to 4 units. Staff.

494. Research. II; ½ to 4 units. Staff.

495. Advanced Studies in Geography. I; ½ to 2 units. Staff.

496. Advanced Studies in Geography. II; ½ to 2 units. Staff.

497. Development of Geographic Thought. A consideration of the various philosophies of geography and of the men who reflect them. II; ½ unit. Page.

Courses for Graduates and Advanced Undergraduates

313. Climates of the Continents. A regional treatment of the climates of the world by continents. I; ½ unit. Prerequisite: Geography 101 and 111. Page.

342. Geography of Europe. Influence of climate, surface features, and natural resources on the distribution of the people, their industries and routes of trade. New boundaries and present economic problems in their geographic setting. II; ½ unit. Prerequisite: Eight hours of geography. Blanchard.

351. Geography of Asia. A regional geography of Asia with concentration on

the monsoon realm of southern and eastern Asia. I; ½ unit. Prerequisite: Eight hours of geography. Booth.

361. Land Utilization. A geographical consideration of the nature of land utilization from the world, continental, and regional viewpoints. Special emphasis will be placed upon geographical techniques of land inventory, methods of land classification, and the detailed investigation of land utilization in this country and abroad. I; ½ unit. Foster.

363. Production of Great World Minerals. Geographic aspects of the mineral industries. I; ½ unit. Prerequisite: Eight hours of geography. Blanchard.

365. Geographic Aspects of Transportation. Geographic factors influencing transportation by land, sea, and air. II; ½ unit. Prerequisite: eight hours of geography. Blanchard.

366. Problems of Industrial Location. The relationship between geographic facts of relief, climate, resources, population, and transportation and the industrial location process. Case studies in the effects of transportation networks and rates, sources of materials, labor supply, location of markets, etc., on the selection and evaluation of industrial sites. I; ½ unit. Prerequisite: Eight hours of geography. Three hours of economic geography for College of Commerce students. Engineering and architecture students may register with consent of instructor. Russell.

373. Map Compilation and Construction. Laboratory instruction and practice in the basic techniques of map making, followed by a consideration of problems involved in the construction of maps for presentation in a reproduced form (i.e., printed, photographed). Included are the selection of proper source materials for the base and body of the map, the compilation and correlation of these materials, and methods of mechanical and photographic reproduction. I; 1 unit. Prerequisite: Consent of instructor. Foster.

375. Map Reading and Interpretation. Evaluation of map components, map reading, map interpretation, map history, and survey of world maps and mapping. I; ½ unit. Prerequisite: Consent of instructor. Booth.

376. Field Geography. Techniques and methods of field investigation; reconnaissance and unit area mapping; collection and use of field data; organization and presentation of materials. Prerequisite: A declared major in geography. II; ½ unit. Foster.

378. Descriptive Interpretation of Aerial Photographs. Reading and interpreting of aerial photographs; their potentialities and limitations as a research tool of geography. II; ½ unit. Prerequisite: Consent of instructor. Booth.

386. Political Geography. World patterns of nations in relation to their natural environmental backgrounds. European nations; Africa, the exploited continent; national structures in Asia; western hemisphere nations. I; ½ unit. Prerequisite: Eight hours of geography. Major or graduate students in political science or history may enroll with consent of instructor. Garland.

371. Introduction to Research. Limited to seniors and graduates whose major is in geography, and to seniors whose major is in other departments who have twelve hours credit in geography, including three hours in a regional course. Only those students who have four hours credit in Geography 372 and 371 and write a thesis will be recommended for graduation with honors. I; ½ unit. Staff.

372. Introduction to Research. Limited to seniors and graduates whose major is in geography, and to seniors whose major is in other departments who have twelve hours credit in geography, including three hours in a regional course. Only those students who have four hours credit in Geography 372 and 371 and write a thesis will be recommended for graduation with honors. II; ½ unit. Staff.

GEOLOGY

Graduate students may take work in geology leading to the degrees of Master of Science and Doctor of Philosophy. Candidates for the master's degree are advised to so plan their work that they secure a firm foundation in geology, rather than to specialize too narrowly. Candidates for the doctor's degree may work in the special fields of clay mineralogy, economic geology, geomorphology, mineralogy and petrography, paleontology and stratigraphy, and sedimentation.

Beginning graduate students admitted to full status in geology must have a grade-point average no lower than 3.75 for that portion of undergraduate work representing the last fifty per cent of the hours completed for the bachelor's degree, exclusive of required physical education and military training. Students on limited status will not be admitted to graduate study in geology.

For graduate work in geology a student must usually have had at least an undergraduate major in geology, including field training, and the requisite courses in chemistry, mathematics, and physics. A reading knowledge of French or German is desirable for the beginning graduate student and requisite for the advanced graduate student. An undergraduate major consists of twenty hours in geology selected from the following courses (or their equivalent): 102, Historical Geology; 131 and 132, Mineralogy; 301, Geomorphology; 311, Structural Geology; 315, Field Methods; 320, Invertebrate Paleontology; and 321, Stratigraphy. Graduate students in other departments may be admitted to graduate courses in geology if they have had the prerequisites for the course desired, or by special permission in certain cases.

A candidate for the master's degree in geology must pass a general examination toward the close of the second semester of residence, covering the fields of geology listed in the courses named above and the graduate courses taken.

Graduate students whose undergraduate training has not included all of the "major" courses listed may take these courses, if listed as "Courses for Graduates and Advanced Undergraduates." More than the minimum of eight units for a master's degree will be required if it is necessary to include an undue number of such "300" courses.

A reasonable choice of minor may be made by students working for the doctor's degree. Ordinarily the minor will be chemistry for those specializing in mineralogy and petrography; chemistry, physics, or mining engineering for economic geology; zoology or botany for paleontology; and agronomy (soils) or geography for geomorphology. Other minors may be chosen with departmental approval.

Fellowships and Assistantships

The Illinois Clay Products Company has established a fellowship for graduate study in the field of clay mineralogy. The stipend is $1,500 for a year's study plus $500 to cover material and equipment and other expenses related to the research project.

A fellowship for graduate study in clay mineralogy has been established by the Baroid Sales Division of the National Lead Company. The stipend is $1,200 for a year's study.

A fellowship established by the Shell Fellowship Committee encourages graduate studies in the field of geology leading to a master's or a doctor's degree.

The stipend is $1,200 for a year's study plus $300 to cover material and equipment and other expenses related to the research project.

There are a number of assistantships available in the Department of Geology. The stipend for half-time assistants is $1,200. Occasional appointments of quarter-time assistants are made at a stipend of $600. Preference is given to applicants who have had some graduate work and who are working for the Ph.D. degree but superior students who have just completed the work for the bachelor's degree will also be considered. Application should be made to the Head of the Department, accompanied by a record of all undergraduate and/or graduate work taken.

Graduate Teaching Faculty

Professors: G. W. White (Head of Department), C. A. Chapman, R. E. Grim, J. L. Hough, H. W. Scott, H. R. Wanless.

Associate Professors: A. F. Hagner, B. Kummel (on leave second semester 1950-1951), P. R. Shaffer.

Assistant Professor: C. Oftedahl (Visiting, first semester 1950-1951).

Courses for Graduates

401. Advanced Dynamic Geology. A study of geologic processes and their effects. I; 1 unit. Prerequisite: Graduate standing in geology or in other departments allowing geology as a minor. Offered in 1951-1952 and in alternate years. Wanless.

402. Advanced Historical Geology. Principles of interpretation and problems of earth history. II; 1 unit. Prerequisite: Graduate standing in geology or in other departments allowing geology as a minor. Offered in 1951-1952 and in alternate years. Wanless.

403. History of Geology. II; ½ to 1 unit. Offered in 1950-1951 and in alternate years. White.

409. Sedimentation. I; 1 unit. Prerequisite: Graduate standing in geology or related sciences. Wanless.

422. Stratigraphic Geology: Paleozoic. I; 1 unit. Prerequisite: Geology 321. Scott.

423. Stratigraphic Geology: Mesozoic and Cenozoic. II; 1 unit. Prerequisite: Geology 321. Kummel.

425. Micropaleontology: Foraminifera. Classification of microfossils, foraminifera; stratigraphic correlation. I; 1 unit. Prerequisite: Geology 320 or Zoology 320. Scott.

426. Micropaleontology: Ostracoda. Classification of microfossils, ostracodes, conodonts, scolecodonts, and other major groups, stratigraphic correlations. II; 1 unit. Prerequisite: Geology 320 or Zoology 320. Scott.

435. Igneous Petrology. The origin and history of igneous rocks. Application of chemistry and physics to igneous petrology. In the laboratory a study is made of selected rock suites, and special methods of petrographical investigation are covered. I; 1 unit. Chapman.

436. Metamorphic Petrology. Problems in metamorphism and advanced studies of metamorphic rocks. In the laboratory, selected rock suites are studied and special methods of investigation are covered. II; 1 unit. Chapman.

437. Sedimentary Petrology. II; 1 unit. Hough.

440. Mineragraphy. Microscopic study of ore minerals including methods of identification, textures, structures, and paragenesis. I; 1 unit. Hagner.

441. Seminar in Mineral Deposition. Critical study of processes and theories of mineral deposition. Laboratory examination of illustrative ore suites, and survey of the literature. II; 1 unit. Hagner.

443. Mineral Deposits. Principles of mineral deposition and genesis of mineral deposits. I; 1 unit. Prerequisite: Geology 311 and 336. Hagner.

444. Mineral Deposits. Structural control of mineral deposition and a study of the principal types of mineral deposits. Laboratory study of structures and of types of deposits. II; 1 unit. Prerequisite: Geology 443. Hagner.

446. Petroleum Geology: Principles. I; 1 unit. Offered in 1951-1952 and in alternate years. Hough.

447. Petroleum Geology: Fields. A continuation of Geology 446. II; 1 unit. Offered in 1951-1952 and in alternate years. Hough.

450. Geology for Civil Engineers. Advanced physical geology, with emphasis on the geological aspects of civil engineering. I; 1 unit. Prerequisite: Geology 150, or equivalent. Hough.

461. Mineralogy of Clays. The composition of various types of clays; the structure and properties of the clay minerals; the origin and mode of occurrence of the clay minerals and clay materials. I; 1 unit. Prerequisite: Geology 336 or Chemistry 328, or equivalent; consent of instructor. Grim.

462. Mineralogy of Clays. The properties of clay materials, their relation to the structure of the clay minerals, methods of determination and control; the utilization of clays in various arts and industries. II; 1 unit. Prerequisite: Geology 461. Grim.

463. Seminar in Clay Mineralogy. A critical review and discussion of current literature on the composition, occurrence, properties, and utilization of clay minerals and clays generally. I; ½ or 1 unit. Prerequisite: Geology 462, or equivalent. Grim.

464. Seminar in Clay Mineralogy. A critical review and discussion of current literature on the composition, occurrence, properties, and utilization of clay minerals and clays generally. II; ½ or 1 unit. Prerequisite: Geology 462, or equivalent.

491. Research (Thesis). Individual work under supervision of members of the staff in their respective fields. I; ½ to 4 units.

492. Research (Thesis). Individual work under supervision of members of the staff in their respective fields. II; ½ to 4 units.

493. Advanced Studies in Geology. Supervised individual study. I; ½ to 2 units.

494. Advanced Studies in Geology. Supervised individual study. II; ½ to 2 units.

Courses for Graduates and Advanced Undergraduates

301. Geomorphology. The study of the history, origin, and characteristics of land forms produced by fluvial, glacial, wind, and wave erosion, or by a combination of these, acting upon the major kinds of geologic materials and structures. I, II; 1 unit. Prerequisite: Geology 102. White.

311. Structural Geology. Rock deformation and its results. Lectures, laboratory, and field trip. I, II; 1 unit. Prerequisite: Geology 102. Oftedahl.

315. Field Methods. Lecture, quiz, and field trips. Mapping of an area in southern Illinois. Credit will be given only on completion of a satisfactory written report. II; ½ unit. Prerequisite: Geology 102. Wanless.

316. Field Geology. A field course covering structural, stratigraphic, glacial, and physiographic features. The emphasis is on methods of study and interpretation. A comprehensive report is required to provide training in geological report writing. Field trip scheduled for August 23 to September 8, 1950; estimated travel expense about $40. Credit for course deferred until written report is submitted. S; 1 unit. Prerequisite: Geology 102, or equivalent; consent of instructor. Hough.

317. Geology of San Juan Region, Colorado. Field course to be conducted from campus of Fort Lewis Agricultural and Mechanical College near Durango, Colorado. Field training in stratigraphy, structure, and geomorphology. Geologic mapping with plane table, and aerial photographs. S; 2 units. Prerequisite: Geology 102; consent of instructor. Wanless.

319. Geology of Illinois. I; ½ unit. Prerequisite: Geology 102. Offered in 1950-1951 and in alternate years. Wanless.

320. Invertebrate Paleontology. Fossil groups in biological sequence. Lectures and laboratory. I, II; 1 unit. Prerequisite: Geology 102. Kummel.

321. Stratigraphy. General stratigraphy, fossil faunas, with special reference to invertebrates, and correlation. Emphasis is placed on the physical history. I, II; 1 unit. Prerequisite: Geology 320. Scott.

325. Paleobotany. Same as Botany 325. The structure, phylogeny, and geological distribution of representative fossil plants. Two or three field trips. II; ½ or 1 unit. Prerequisite: Botany 100, or Division of General Studies 131 and 132 and Geology 101, or consent of instructor. Offered in 1950-1951 and in alternate years. Stewart.

335. Optical Mineralogy. Study of the optical properties of minerals and the use of the petrographic microscope. Emphasis is placed on the identification of minerals by the immersion method. Designed for students in geology, ceramics, chemistry, mining, and agriculture. I; 1 unit. Prerequisite: Geology 132. Chapman.

336. Petrography. Study of the constituents, composition, textures, structures, and classification of rocks. In the laboratory, rocks are studied in hand specimen and thin section. Emphasis is placed on the ordinary methods of petrographical investigation. II; 1 unit. Prerequisite: Geology 335. Chapman.

351. Geophysics of Mining. Same as Mining Engineering 351. Principles of geophysics and their application to mining processes. I; 1 unit. Prerequisite: Consent of instructor. Chedsey.

GERMAN

The Department of German offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy. Students applying for admission must have a 3.75 grade-point average for that portion of the work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students on

limited status will not be admitted. They should have completed a four-year course of undergraduate study in German corresponding to the four-year course at this University. They should be familiar with the principal works of the writers of the classical and modern periods of German literature, possess a general knowledge in the history of German letters and civilization, and be able to follow lectures in the German language. Acquaintance with German history, philosophy, and art in their relation to the general European background is highly desirable. A reading knowledge of French is important and is required for advanced graduate work. Likewise some fluency in Latin is seriously recommended.

Fields of concentration for advanced degrees include German philology and linguistics, medieval literature, and modern literature. Such studies are greatly facilitated by an excellent library collection which is particularly strong in German literature from the seventeenth to the twentieth century. Special collections include the following items: the German folksong collection (including the Vaticana), the John Meier collection, the Moritz Heyne collection in German philology, the Armin Rattermann collection of German-Americana, the Bab-Feldman collection in modern German drama, and many others.

Candidates for the degree of Master of Arts in the Teaching of German must earn four units in German, two units in education, and two units in electives. Requirements are German, two to two and one-half units to be chosen from the following courses: German 301, 302, 311, 312, 315, 320, 331, or 332; one and one-half to two units from German courses open only to graduates; education, two units, including two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit. The electives must be selected with the approval of the adviser. The electives may be in German, in education, or, in exceptional cases, in other fields. The grade-point average required for admission is the same as that required by the department. No limited status students will be admitted to this program. The adviser for candidates for this degree is Professor Mimi I. Jehle, 217 Lincoln Hall.

Fellowships

Information concerning fellowships may be obtained from the office of the Graduate College. Students desiring graduate assistantships or information on graduate course requirements and suggested readings should apply directly to the Department of German.

Graduate Teaching Faculty

Professors: H. Rehder (Head of Department), J. T. Geissendoerfer (on leave first semester 1950-1951), D. W. Schumann, G. Waterhouse (first semester 1950-1951).

Associate Professors: J. R. Frey, F. J. Nock, E. A. Philippson, H. Stegemeier.

Assistant Professor: Mimi I. Jehle.

Courses for Graduates

400. Beginning German for Graduate Students. Introduction into the reading of German texts in the sciences and the humanities. Designed for graduate students desiring help in preparing for German reading requirements for the Ph.D. degree. I, II; 4 hours. No graduate credit. Nock.

401. Seminar. Seminar in methods of literary criticism. I, II; ½ to 1 unit.

415. Middle High German. I; 1 unit. Prerequisite: Three years of college German or equivalent. Philippson.

416. History of the German Language. II; 1 unit. Philippson.

426. Gothic. An introduction to Germanic (comparative) linguistics. II; 1 unit. Offered in 1951-1952 and in alternate years. Philippson.

431. German Literature of the Middle Ages. German literature from 800 to 1400. I; 1 unit. Offered in 1951-1952 and in alternate years. Philippson.

432. German Literature from 1400 to 1700. Renaissance, Reformation, and Baroque in German literature. Lectures and readings. II; 1 unit. Offered in 1951-1952 and in alternate years. Rehder.

441. Modern German Literature. I; 1 unit. Offered in 1950-1951 and in alternate years. Schumann.

445. Old High German. Grammar and interpretation of the oldest literary documents. I or II; 1 unit. Offered in 1950-1951 and in alternate years. Philippson.

450. Readings in German for Graduate Students. Designed for graduate students desiring help in preparing for the German reading requirements for the Ph.D. degree. I, II; 3 hours. No graduate credit. Prerequisite: German 400. Nock.

451. German Romanticism. Early romanticism. II; 1 unit. Offered in 1951-1952 and in alternate years. Geissendoerfer.

458. Intellectual Backgrounds of German Literature. Social and philosophical currents reflected in German literature (eighteenth to twentieth century). II; 1 unit. Prerequisite: German 301 and 302, or equivalent. Offered in 1950-1951 and in alternate years. Rehder.

460. Seminar in German Literature. Advanced research work in German literature; discussion of problems and papers. II; 1 unit. Prerequisite: German 301 and 302; three to four units in literature courses for advanced undergraduates and graduates. Rehder, Schumann.

491. Thesis. I; ½ to 4 units. Rehder.

492. Thesis. II; ½ to 4 units. Rehder.

493. Research in Special Topics. I; ½ to 4 units. Staff.

494. Research in Special Topics. II; ½ to 4 units. Staff.

495. Bibliography and Methods in Literary History. To be taken concurrently with German 401. I; ½ unit. Frey.

Courses for Graduates and Advanced Undergraduates

301. German Literature to the Eighteenth Century. I; 1 unit. Prerequisite: Three years of college German, or equivalent. Frey.

302. German Literature Since the Eighteenth Century. II; 1 unit. Prerequisite: Three years of college German, or equivalent. Frey.

311. Goethe. Introduction to Goethe's life and works. I; 1 unit. Prerequisite: Three years of college German. Offered in 1950-1951 and in alternate years. Waterhouse.

312. Goethe's Faust. Intensive study of Goethe's Faust, Parts I and II. II;

1 unit. Prerequisite: Three years of college German, or equivalent. Offered in 1950-1951 and in alternate years. GEISSENDOERFER.

320. HISTORY OF GERMAN CIVILIZATION. A selected topical, historical, and pictorial analysis of German culture and civilization. II; 1 unit. Prerequisite: Three years of college German, or equivalent. STEGEMEIER.

331. GERMAN CLASSICS I. Study of works of Lessing, Herder, and Wieland. I; 1 unit. Prerequisite: Three years of college German, or equivalent. Offered in 1951-1952 and in alternate years.

332. GERMAN CLASSICS II. Study of the works of Schiller, Kleist, Hölderlin, and Jean Paul. II; 1 unit. Prerequisite: Three years of college German, or equivalent. Offered in 1951-1952 and in alternate years. GEISSENDOERFER.

360. INTRODUCTION TO GERMAN PHONETICS. I; ½ unit. NOCK.

363. INTRODUCTION TO COMPARATIVE LITERATURE. Same as English 363. A comparative study of great books in Greek, Roman, Italian, and Spanish literature. I; ½ unit. HAMILTON, LANDIS, VAN HORNE.

364. INTRODUCTION TO COMPARATIVE LITERATURE. Same as English 364. A comparative study of the great books in French, German, and English literature. II; ½ unit. JACOB, LANDIS, REHDER.

GOVERNMENT AND PUBLIC AFFAIRS

The Institute of Government and Public Affairs has been established to develop a program of training for the public service, to provide in-service training for state and local government employees, to hold institutes and conferences for citizens and public officials, and to carry out a research program in the field of government and public affairs. The Institute serves as a planning and directing agency to correlate the work of existing colleges and departments in the field of public affairs. Royden Dangerfield is the Director.

HISTORY

The Department of History offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy. Professors C. E. Nowell and C. G. Starr form the department's committee in general charge of advising graduate students in history. Graduate work in history presupposes two years of college work in this subject, or sixteen semester hours, which should include courses in European and American history equivalent to History 111, 112, 151, and 152. Linguistic preparation, especially in French and German, is important. For ancient and medieval history some knowledge of Latin is essential. Spanish is useful for certain fields of American and Latin-American history.

Beginning graduate students admitted to full status in the Department of History must have a grade-point average no lower than 3.5 for that portion of undergraduate work representing the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students may be admitted on limited status.

Graduate courses in history at the University of Illinois are of three kinds: (1) lecture courses providing information, interpretation, and guidance in general reading; (2) instruction in methodology, historiography, and bibliography (History 495 and 496 are required of all graduate students in history during their first year); (3) seminars for the study of special fields with a view to training in methods of historical criticism and research and in the writing and presentation of historical essays.

The following statement regarding the specific requirements for higher degrees in history conforms to the general requirements of the Graduate College.

Degree of Master of Arts in History. Shortly after his registration each candidate for this degree is required to take a comprehensive examination based on his undergraduate work in history. Questions are given in the following four fields of history: ancient, medieval and modern European, English, and American. Candidates must answer questions in three out of four fields. Each candidate must have a reading knowledge of one foreign language, ordinarily French or German, as demonstrated by an oral examination administered by the department. Each candidate is expected to devote special attention to two of the following fields: ancient history, medieval history of continental Europe, modern history of continental Europe, English history, American history, Latin-American history, and the history of the Far East. Each candidate is also expected to write a master's thesis in one of the fields of his specialization. By special permission he may substitute a third field for the thesis requirement. To constitute a field of specialization a minimum of two units of graduate study is ordinarily required.

Graduate study in history may also be pursued in connection with the degrees of Master of Arts in the Social Sciences and Master of Arts in the Teaching of Social Studies (see page 235).

Degree of Doctor of Philosophy in History. The candidate who selects history as his major subject should prepare himself for a preliminary examination in five fields, of which four are normally in history and one is in an outside related subject.

The preparation of the candidate should include a minimum of four units in the field of history in which he wishes to specialize and in which his thesis is to be written. This field constitutes his major.

There should be a minimum of three units in a second field known as the first minor, and two units each in three other fields. One of these, outside the department, constitutes the second minor.

The Department of History offers the following fields of specialization and preparation: ancient history, medieval history, continental Europe from 1300 to 1648 (Renaissance and Reformation), continental Europe and its dependencies since 1648, England and its dependencies, the United States, and Latin America. This enumeration of fields is not to be regarded as excluding the possibility of accepting others as may be determined by the department in individual cases.

The second minor field may be selected from the following departments and areas, although other suitable second minors may be arranged through consultation with department advisers:

Political Science. (1) International law and diplomacy, (2) modern government, (3) municipal government, (4) constitutional and administrative law and jurisprudence, (5) political theory.

Economics and Sociology. (1) Economic history, (2) economic theory, (3) public and private finance, (4) social reform, (5) principles of sociology.

Philosophy and Education. (1) History of ancient and medieval philosophy, (2) history of modern philosophy, (3) history of education.

Literature. Some division of the history of literature, which may be either comparative literature of a limited period or the literature of a particular country for a more extended period as may be agreed upon in each case.

Graduate students have an opportunity to pursue research in connection with the Illinois Historical Survey, an organization carrying on systematic studies in the history of the Midwest. Through the use of materials collected by this survey, graduate students in the Department are provided with opportunities of useful training in the study of manuscript as well as printed materials.

Doctoral candidates interested in specializing in American culture may elect a major in American history with a first minor (three-unit field) in American literature, and the second minor (two-unit field) in the history of fine arts in the United States.

Fellowships and Assistantships

The Department awards annually to the ranking student in English or medieval history the Laurence M. Larson Memorial Fellowship, which represents the income from a fund of $5,000 set up in the will of Lillian D. Larson in memory of her husband, at one time head of the Department of History.

The Department participates with the Department of Political Science in the Kendric C. Babcock Fellowship established under the will of Dean Kendric C. Babcock. For the third year these appointments carry a stipend of $1,000, and post-doctoral grants carry a stipend of $2,400. Nominations for these fellowships are made by the heads of the departments of History and Political Science. Application forms may be obtained from the Graduate College office.

The Department has available a certain number of teaching assistantships which carry the requirement of six hours teaching per week in elementary sections. Before being considered for these appointments, students must have been in attendance in the Graduate College in the Department of History for at least a year, they must have done work of high distinction, and have received the master's degree. There are no formal application forms for applying for these appointments. Correspondence regarding them should be addressed to the Head of the Department. There are also certain research assistantships available. These are subject to the same general regulations as teaching assistantships.

Graduate Teaching Faculty

Professors: F. C. Dietz (Head of Department), C. E. Nowell, F. S. Rodkey, F. A. Shannon, R. P. Stearns, J. W. Swain, R. C. Werner.

Associate Professors: A. E. Bestor, Jr., R. N. Current, E. L. Erickson, C. G. Starr, Jr. (on leave 1950-1951).

Assistant Professors: Natalia M. Belting, Louise B. Dunbar, F. Freidel, Mary L. Shay, J. B. Sirich.

Instructors: W. J. Bouwsma, C. E. Dawn.

Courses for Graduates

401. Seminar in Medieval History. An introduction to medieval historians. I; 1 unit.

402. Seminar in Medieval History. Medieval struggles for world unity. II; 1 unit.

409. Seminar in Modern History: The Enlightenment. I; 1 unit. Prerequisite: Reading knowledge of one major European language other than English. Stearns.

410. Seminar in Modern History: The Enlightenment. Variation of the topics treated in History 409 as student interest and ability (or previous work) necessitates. II; 1 unit. Prerequisite: Reading knowledge of one major European language other than English. Stearns.

411. The French Revolution. A seminar in the history of France and her relations with Europe, 1789 to 1799. I; 1 unit. Sirich.

412. Napoleon. A seminar in the history of France and her relations with Europe, 1799 to 1815. II; 1 unit. Sirich.

419. Seminar in the History of Europe with Emphasis on Russia, 1815 to 1848. I; 1 unit. Rodkey.

420. Seminar in the History of Europe with Emphasis on Russia, 1848 to 1870. II; 1 unit. Rodkey.

431. Seminar in English History. I; 1 unit. Dietz.

432. Seminar in English History. II; 1 unit. Dietz.

452. Seminar in American History. Introduction to research. I; 1 unit. Freidel.

453. Problems in the Social History of the United States Before 1860. A seminar in the social and economic history of the United States before 1860. Students will work on individual problems related to a general topic and will give oral and written accounts in class of the progress and results of their research. I; 1 unit. Shannon.

454. Problems in the Social History of the United States Since 1860. A seminar in the social and economic history of the United States after 1860. Students will work on individual problems related to a general topic and will give oral and written accounts in class of the progress and results of their research. II; 1 unit. Shannon.

455. The Westward Movement, 1749 to 1755. I; 1 unit. Current.

456. The Westward Movement, 1755 to 1763. II; 1 unit. Current.

458. Seminar in American History: The Revolutionary Period. I; 1 unit. Dunbar.

471. Seminar in the Intellectual History of the United States, 1789 to 1860. I; 1 unit. Bestor.

472. Seminar in the Intellectual History of the United States, 1860 to 1948. II; 1 unit. Bestor.

473. Graduate Survey of American History to 1865. I; 1 unit. Prerequisite: Two courses in American history at the 300 level. Current.

474. Graduate Survey of American History Since 1865. II; 1 unit. Prerequisite: Two courses in American history at the 300 level. Current.

475. Seminar in Latin-American History: The A.B.C. Powers and Mexico. I; 1 unit. Nowell.

476. Seminar in Latin-American History: The Revolutionary Period. Studies in the history of Latin America during the first half of the nineteenth century; emphasizes research in special topics. II; 1 unit. Nowell.

482. Seminar in Ancient History. I; 1 unit. Swain.

491. Research in Special Topics. Individual direction in research and guidance in writing theses for advanced degrees. I; 1 to 4 units. Staff.

492. Research in Special Topics. Individual direction in research and guidance in writing theses for advanced degrees. II; 1 to 4 units. Staff.

495. Historical Method. Required of all candidates for an advanced degree in history who do not present evidence of similar training elsewhere. I; 1 unit. Bestor.

496. History of Historiography. II; 1 unit. Swain.

Courses for Graduates and Advanced Undergraduates

301. The Middle Ages, 400 to 1100 A.D. Europe from the fall of Rome to the first crusade. I; ½ to 1 unit.

302. The Middle Ages, 1100 to 1500 A.D. Europe from the rise of towns to the establishment of national monarchy. II; ½ to 1 unit.

304. Medieval Civilization. Religious and intellectual. II; ½ to 1 unit.

305. The Age of the Renaissance. I; ½ to 1 unit. Bouwsma.

306. The Age of the Protestant and Catholic Reformation, 1500 to 1648. II; ½ to 1 unit. Bouwsma.

307. Classical Islam: The Near East from Mohammed to the Crusades. I; ½ to 1 unit. Dawn.

308. The Europeanization of the Near East, 1768 to 1914. II; ½ to 1 unit. Dawn.

309. Development of Modern Europe, 1648 to 1798: Absolutism and Colonial Expansion. I; ½ to 1 unit. Sirich.

310. The French Revolution and Napoleon, 1789 to 1815. II; ½ to 1 unit. Sirich.

311. Europe from 1815 to 1860. I; ½ to 1 unit.

312. Europe from 1860 to 1900. II; ½ to 1 unit.

313. European History, 1900 to 1925. I; ½ to 1 unit. Shay.

314. European History, 1925 to the Present. II; ½ to 1 unit. Shay.

317. History of Modern Italy, 1700 to 1830. I; ½ unit. Shay.

318. History of Modern Italy, 1831 to 1948. II; ½ unit. Shay.

319. Tsarist Russia: Its Background, Expansion, and Problems to 1815. A survey of what is basic in the cultural heritage of the Russian people and the Russian state up to the revolutionary era. I; ½ to 1 unit. Rodkey.

320. Modern Russia and Its Problems, 1815 to the Present. An analysis of the various currents and factors that have accounted for what is now dominant in the culture and organization of the Soviet Union. II; ½ to 1 unit. Rodkey.

322. History of Spain and Portugal. A survey of the Iberian Peninsula from the earliest times until the present. I; ½ to 1 unit. Nowell.

323. Science, Philosophy, and the Modern European Mind. Intellectual history of modern Europe, 1543 to 1770. I; ½ to 1 unit. Prerequisite: One of the following: History 111 and 112, 131 and 132, Division of General Studies 121 and 122, English 111 and 112, or Philosophy 101. Sirich, Stearns.

324. Science, Idealism, and Materialism. Intellectual history of modern Europe, 1770 to 1914. II; ½ to 1 unit. Prerequisite: History 323, or consent of instructor. Sirich.

325. Intellectual and Cultural History of Russia to 1881. I; ½ to 1 unit. Rodkey.

326. Intellectual and Cultural History of Russia 1881 to the Present. II; ½ to 1 unit. Rodkey.

333. The History of England from 1377 to 1485. I; ½ to 1 unit. Offered in 1951-1952 and in alternate years. Dietz.

334. The History of England Under the Tudors, 1485 to 1603. II; ½ to 1 unit. Offered in 1951-1952 and in alternate years. Dietz.

335. Foundations of English and American Democratic Institutions, 1603 to 1689. I; ½ to 1 unit. Stearns.

336. Development of English and American Democratic Institutions, 1689 to 1783. II; ½ to 1 unit. Stearns.

339. History of the British Commonwealth in the Nineteenth and Twentieth Centuries, 1783 to 1870. I; ½ unit. Prerequisite: One year of college history, preferably History 131 and 132, though 111 and 112 and 151 and 152 satisfy the requirement. Erickson.

340. History of the British Commonwealth in the Nineteenth and Twentieth Centuries, 1870 to the Present. II; ½ unit. Prerequisite: One year of college history, preferably History 131 and 132, though 111 and 112 and 151 and 152 satisfy the requirement. Erickson.

343. Social and Economic History of England Since the Beginning of the Industrial Revolution. Social and economic history of England, 1750 to 1848. I; ½ to 1 unit. Offered in 1950-1951 and in alternate years. Dietz.

344. Social and Economic History of England Since the Beginning of the Industrial Revolution. Social and economic history of England since 1848. II; ½ to 1 unit. Offered in 1950-1951 and in alternate years. Dietz.

345. Constitutional History of England to 1485. I; ½ to 1 unit. Dietz.

346. Constitutional History of England from 1485 to the Present. II; ½ to 1 unit. Dietz.

349. The Age of Discovery. I; ½ to 1 unit. Offered in 1950-1951 and in alternate years. Nowell.

352. The American Colonies in the Seventeenth and Eighteenth Centuries. I; ½ to 1 unit. Werner.

354. Foundations of American Society: The Transition to National Life and Organization, 1763 to 1789. II; ½ to 1 unit. Dunbar.

357. Social and Economic History of the United States, 1775 to 1860. The growth of American economic life and institutions from the Revolution to the outbreak of the Civil War. I; ½ to 1 unit. Prerequisite: History 152. Shannon.

358. Social and Economic History of the United States Since 1860. The growth of American economic life and institutions since 1860. II; ½ to 1 unit. Prerequisite: History 152. Shannon.

359. The Civil War and Reconstruction. Remote and immediate causes of the Civil War, especially from 1850 to 1861; problems of the North and South during the war; the consequences of the war; the efforts to create a new Union, 1865 to 1877, and the new problems created by those efforts. I; ½ to 1 unit. Shannon.

361. History of the United States, 1877 to 1917. I; ½ to 1 unit. Freidel.

362. History of the United States Since 1917. II; ½ to 1 unit. Freidel.

363. History of the West, 1634 to 1774. I; ½ unit. Belting.

364. History of the West, 1774 to 1830. II; ½ unit. Belting.

365. History of Illinois from 1809 to the Present. Evolution of a typical middle western commonwealth. I; ½ unit. Sutton.

369. Political and Constitutional Development of the United States to 1865. I; ½ to 1 unit. Freidel.

370. Political and Constitutional Development of the United States Since 1865. II; ½ to 1 unit. Freidel.

371. American Intellectual and Cultural History to 1877. The contribution of social and political thought, religion, science, scholarship, and education to the history of American civilization. I; ½ to 1 unit. Bestor.

372. American Intellectual and Cultural History Since 1877. The contribution of social and political thought, religion, science, scholarship, and education to the history of American civilization. II; ½ to 1 unit. Prerequisite: History 371. Bestor.

373. Diplomatic History of the United States to the End of the Nineteenth Century. I; ½ to 1 unit. Offered in 1950-1951 and in alternate years. Current.

374. Diplomatic History of the United States in the Twentieth Century. II; ½ to 1 unit. Offered in 1950-1951 and in alternate years. Current.

375. History of Latin America to 1824. A survey of Latin-American history from the discovery of America until 1824. I; ½ to 1 unit Nowell.

376. Latin America Since 1824. A history of the Latin-American republics from their independence to the present. II; ½ to 1 unit. Nowell

377. History of the A.B.C. Powers. History of Argentina, Brazil, and Chile from their origins to the present. I; ½ unit. Offered in 1951-1952 and in alternate years. Nowell.

378. History of the Caribbean Area. A survey of the Caribbean, Mexico, and Central America from the discovery of America to the present. I, II; ½ unit. Offered in 1951-1952 and in alternate years. Nowell.

381. Ancient Greek States. History of the Greek States from the earliest times to 334 B.C. I; ½ to 1 unit. Swain.

382. Alexander and His Successors. II; ½ to 1 unit. Swain.

383. The Roman Republic. History of the Roman Republic to 44 B.C. I; ½ to 1 unit. Swain.

384. Ancient Imperialism. The Roman Empire. II; ½ to 1 unit. Swain.

391. History of Eastern Asia to 1839. History of eastern Asia (China, Japan, and Korea) to 1839. I; ½ unit. Werner.

392. History of Eastern Asia Since 1839. History of eastern Asia (China, Japan, and Korea) since 1839. II; ½ unit. Werner.

HOME ECONOMICS

The Department of Home Economics offers graduate work leading to the degrees of Master of Science or Master of Arts in Home Economics. The major work may be done in one of five curricula: (1) child development and family relationships, (2) family housing and household management, (3) foods and nutrition, (4) general home economics, or (5) textiles and clothing. The degree of Master of Science in Home Economics Education is granted to those students who take their major work in the field of home economics education.

Students who elect home economics as their major subject for a master's degree should have complied with the undergraduate requirements of the specific

Graduate Students Conducting an Experiment in the Nutrition Research Laboratory

field of concentration selected or should have had equivalent training. To be admitted with full status the grade-point average for that portion of work representing the last fifty per cent of undergraduate work must be at least 3.5, exclusive of required courses in physical education and military training. Students on limited status are accepted. All candidates for a master's degree in home economics must take a minimum of eight units; four of these to be in home economics. Four units, either in home economics or electives, are to be courses numbered 400 or above.

Recommended home economics courses, suggested electives, and special requirements for each of the five curricula are as follows:

(1) *Child Development and Family Relationships.* Four units from Home Economics 301, 410, 481, 482; and four units from Anthropology 261; Education 317, 431; Psychology 412, 436; Social Welfare Administration 414, 451, 452, 465; Sociology 412, 481; or Speech 385.

(2) *Family Housing and Household Management.* Two and one-half units from Home Economics 361, 378, 493, and Agricultural Engineering 393. Additional units to complete the requirement of at least four in home economics from Home Economics 301, 377, 379, 380, 388, 389, 410. Four units may be selected from Agriculture 400; Agricultural Economics 341, 497; Economics 378, 379, 380; Education 453; Sociology 400, 477.

(3) *Foods and Nutrition.* A minimum of four units from Home Economics 320, 322, 324, 330, 331, 420, 423, 481, 482, 493, 494. Four units may be selected from Animal Nutrition 401, 402, 404; Bacteriology 308, 309; Chemistry 421, 426, 450, 452; or Physiology 306, 307. (Chemistry 350 or 240 and 241 are required.)

(4) *General Home Economics.* Four units from prescribed courses in three of the following curricula: (1), (2), (3), or (5). Additional units may be taken in home economics, economics, education, psychology, or sociology.

(5) *Textiles and Clothing.* Three units from Home Economics 380, 386, 388, 389, 395, 493, 494, and one additional unit in home economics. Four units may be taken in related fields and courses: Art; Business Organization and Operation 401, 402, 407, 421, 449; Economics 400, 401, 436, 437; Psychology 441; Sociology 422, 444, 476, 477, 481.

Graduate students who choose home economics as their minor for the degree of Doctor of Philosophy must have adequate preparation in home economics, and must complete three units for a first minor or two units for a second minor, in addition to credit offered for the master's degree. At least one unit must be taken in courses numbered above 400.

Candidates for the degree of Master of Science in Home Economics Education must earn eight units as follows: home economics, two to two and one-half units; education, three and one-half to four units; electives, two units. The requirements are (1) two to two and one-half units of home economics chosen from courses in home management (Home Economics 361, 378, 379, 481 and/or 482), foods and nutrition (Home Economics 320, 322, 330, 331), textiles and clothing (Home Economics 380, 386, 388, 395), child development and family relationships (Home Economics 301, 378, 379, 410); (2) Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit; (3) two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; (4) Education 453, Seminar in Home Economics Education, one unit; (5) Education 452, Curriculum Problems and Trends in Home Economics Education, one unit, or Home Economics 377, Home Economics Extension (Adult Education), one-half unit. The elective courses must be selected with the approval of the advisers, Professor Janice M. Smith, Head of the Department of Home Economics, 109 Bevier Hall, and Professor Letitia Walsh, 102 Gregory Hall.

Assistantships

There are part-time research and teaching assistantships available in the various areas of home economics. An applicant should have a satisfactory scholastic record and strong professional interest in the area. Applications should be sent to Dr. Janice M. Smith, Head of the Department of Home Economics, 109 Bevier Hall. To be considered, applications must be received by April 1 prior to the academic year for which an assistantship is desired.

Graduate Teaching Faculty

Professors: Janice M. Smith (Head of Department), Kathryn V. Burns, D. G. Carter, Nellie L. Perkins, E. Roberts.

Associate Professors: Harriet T. Barto, Doris J. Brockway, Pearl Z. Janssen, Florence M. King, E. Evelyn Smith, Frances O. Van Duyne.

Assistant Professors: Margaret R. Goodyear, Beula V. McKey.

Courses for Graduates

410. Problems in Family Living. Family relationships and their significance to the growth of family members. I or II; 1 unit. Prerequisite: Sociology 220 or its equivalent and consent of instructor. Perkins.

423. Problems in Human Nutrition. Methods of assessing nutritional status of humans. II; ½ to 1 unit. Prerequisite: Home Economics 324, or equivalent desirable. J. M. Smith.

481. Seminar.
   (a) Child Development and Family Relationships. Emphasis on the child. Advanced problems. I; 1 unit. Prerequisite: Undergraduate course in child development. Perkins.
   (b) Nutrition. I; ½ unit. J. M. Smith.

482. Seminar.
   (a) Child Development and Family Relationships. Emphasis on the family. Advanced problems. II; 1 unit. Prerequisite: Home Economics 410. Perkins.
   (b) Foods. Study and discussion of recent research. II; one-half unit. Van Duyne.
   (c) Textiles and Clothing. II; ½ to 1 unit.

493. Research. Work may be taken in the following subjects: (a) the child and the family, (b) family housing, (c) foods, (d) nutrition, (e) textiles and clothing. I; ½ to 3 units. Carter, King, Perkins, J. M. Smith, Van Duyne.

494. Research. Work may be taken in the following subjects: (a) the child and the family, (b) family housing, (c) foods, (d) nutrition, (e) textiles and clothing. II; ½ to 3 units. Carter, King, Perkins, J. M. Smith, Van Duyne.

Courses for Graduates and Advanced Undergraduates

301. Advanced Problems in Home Guidance of Children. Emphasis is placed upon the functions and relations of routine and creative activities and the interplay of personalities in the total behavior patterns with a view to

helping students understand the less obvious and more subtle aspects of child development, to differentiate between desirable and undesirable guidance procedures practiced by adult members of the family. II; ½ to 1 unit. Prerequisite: Home Economics 201 and 202; consent of instructor. PERKINS.

305. HUMAN HEREDITY. Heredity in man and its relation to various individual and social problems. I; ½ unit. Graduate credit does not count towards a major in genetics. ROBERTS.

320. DIET IN DISEASE. Readings, reports, and laboratory experience with therapeutics. I, II; ½ unit. Prerequisite: Home Economics 220. BARTO.

321. FOODS AND NUTRITION. Recent developments in chemistry, digestion, and metabolism of nutrients. S; ½ unit. Prerequisite: Home Economics 220. Offered in 1951-1952 and in alternate years. J. M. SMITH.

322. PHYSICAL GROWTH AND NUTRITION. Lecture, readings, and discussions. I; ½ unit. Prerequisite: Home Economics 220; consent of instructor. J. M. SMITH.

324. PROBLEMS IN NUTRITION. Discussions and investigations. II; ½ to 1 unit. Prerequisite: Home Economics 220; Chemistry 350. MCKEY, J. M. SMITH.

328. READINGS IN FOOD AND NUTRITION. Reports, discussions, and review of scientific literature. I; ¼ unit. Prerequisite: Home Economics 220; credit or registration in one of the following: Chemistry 350, Home Economics 320, 322, 324, 330, or 331. BARTO, VAN DUYNE.

329. READINGS IN FOOD AND NUTRITION. Reports, discussions, and review of scientific literature. II; ¼ unit. Prerequisite: Home Economics 220; credit or registration in one of the following: Chemistry 350; Home Economics 320, 322, 324, 330, or 331. BARTO, VAN DUYNE.

330. EXPERIMENTAL FOODS. A consideration of the manner in which such variables as ingredients, proportions, and techniques in food preparation affect the quality of the product. I, II; ½ unit. Prerequisite: Home Economics 232; Bacteriology 104. JANSSEN.

331. PROBLEMS IN FOODS. Applications of chemical and physical principles to advanced food problems. II; ½ unit. Prerequisite: Home Economics 330. VAN DUYNE.

345. INSTITUTION MANAGEMENT. Purchase of food supplies and equipment for institutions; grades of food, judging of quality and cost in relation to season, pure food laws, and government inspection; the storeroom and its management; equipment and furnishing; institution housekeeping, floor plans and routing; specifications for equipment; inventory of equipment; visits to stores and markets. I, II; ½ unit. Prerequisite: Credit or registration in Home Economics 240 and Economics 108; consent of instructor. E. E. SMITH.

350. INSTITUTION DIETARIES AND ADMINISTRATION. Dietary studies and menu making for various types of institutions, such as dormitories, cafeterias, hospitals, and tearooms; problems of organization, personnel studies, administration of food service, records and cost accountings, professional ethics. Opportunity will be given for observation and practice in various fields. Field trip is required: approximate cost, $40. II; ½ to 1 unit. Prerequisite: Home Economics 220 and 240; consent of instructor. E. E. SMITH.

351. PROBLEMS IN GROUP FEEDING WITH EMPHASIS ON SCHOOL LUNCH. Planned for teachers and others wishing to enter the field of institution manage-

ment, especially as managers or supervisors of school lunch program. Laboratory practices, demonstrations, discussions, individual problems. S; ½ unit. Prerequisite: Home Economics 232 and 220 or equivalent; consent of instructor. Food handlers' certificate required. E. E. SMITH.

355. ADVANCED QUANTITY COOKERY AND CATERING. Planned for students in the restaurant management curriculum and for other qualified students. Practice in menu making and aspects of management necessary for special catering functions and meal projects. Special lectures and demonstrations emphasizing the artistry of preparation, serving, and merchandising of quality food. Supervised practice in various food service units. Field trips and special assignments. II; ½ unit. Prerequisite: Home Economics 350; consent of instructor. E. E. SMITH.

361. FARM HOME PLANNING IN RELATION TO FUNCTION. Same as Agricultural Engineering 361. A study of farmhouse conditions, needs, and functions; basic principles and their application to planning, remodeling, and building; financial and management factors; federal, state, and private housing programs. Lectures, discussions, and problems. II; ½ unit. Prerequisite: Home Economics 272, or consent of instructor. CARTER.

377. HOME ECONOMICS EXTENSION. History and development; types of county organizations; objectives; extension teaching tools; county program determinations and evaluation. Field trips. II; ½ unit. Prerequisite: Consent of instructor. BURNS.

378. PROBLEMS IN HOME MANAGEMENT. Individual investigation and reports of specific problems in the field of home management. I; ½ unit. Prerequisite: Home Economics 272; consent of instructor. GOODYEAR, PERKINS.

379. PROBLEMS IN HOME MANAGEMENT. Individual investigation and reports of specific problems in the field of home management. II; ½ unit. Prerequisite: Home Economics 272; consent of instructor. GOODYEAR, PERKINS.

380. TEXTILES. Textiles from the economic, artistic, physical, and chemical viewpoints. I; ½ unit. Prerequisite: Home Economics 180; Chemistry 132; Economics 108; consent of instructor. KING.

386. CLOTHING DESIGN AND CONSTRUCTION. Problems in creating original designs, developing a more thorough understanding of the figure through design adaptation. Emphasis on adaptability to fabric draping or flat pattern construction. Investigation of sources of inspiration and relationship to significant trends in design. II; 1 unit. Prerequisite: Home Economics 286 and 285. BROCKWAY.

388. PROBLEMS IN TEXTILES AND CLOTHING. Investigation and report of specific problems in the field of textiles and clothing. I; ½ unit. Prerequisite: Home Economics 286 or 380; consent of instructor. Each student will undertake an individual problem which in some cases may involve prerequisites in chemistry and physics. BROCKWAY, KING.

389. PROBLEMS IN TEXTILES AND CLOTHING. Investigation and report of specific problems in the field of textiles and clothing. II; ½ unit. Prerequisite: Home Economics 286 or 380; consent of instructor. Each student will undertake an individual problem which in some cases may involve prerequisites in chemistry and physics. BROCKWAY, KING.

395. FASHION ANALYSIS. Factors affecting design, production, distribution, promotion, and trends in fashion development; forecasting methods of measurement and prediction; price levels — relation to fashion cycle and quality in design and workmanship. II; ½ unit. Prerequisite: Consent of instructor. BROCKWAY.

HORTICULTURE

Graduate work is offered in the Department of Horticulture leading to the Master of Science and Doctor of Philosophy degrees. Candidates may specialize for either degree in floriculture, plant breeding, plant pathology, pomology, or vegetable crops.

The Department requires a grade-point average of 4.0 for that portion of work which represents the last fifty per cent of the hours completed for the bachelor's degree, exclusive of required physical education and military training, and will not accept students on limited status.

Twenty hours of undergraduate work in horticulture and allied subjects are required of students who choose horticulture as a major, and twelve hours are required of those who select it as a minor. The department will waive certain of these requirements for some fields of major study if the student has had an equivalent preparation in the fundamental sciences. It is desirable, when the major field of study is decided upon during the junior or senior year, to select the fundamental science courses accordingly and, if possible, to include in the undergraduate preparation the elementary courses in German or French.

Advanced work in botany, chemistry, entomology, agronomy, genetics, or agricultural economics may be taken advantageously with horticulture to make a well balanced course of graduate study.

Graduate Teaching Faculty

Professors: C. J. Birkeland (Head of Department), H. W. Anderson (on leave second semester 1950-1951), A. S. Colby, W. A. Huelsen, M. B. Linford.

Associate Professors: J. R. Kamp, V. W. Kelley, M. B. Linn, R. V. Lott, J. P. McCollum (on leave second semester 1950-1951), D. Powell, H. H. Thornberry, F. F. Weinard.

Assistant Professor: D. Gottlieb.

Courses for Graduates

404. Plant Virology. Same as Botany 404 and Plant Pathology 404. Fundamental concepts; classification, symptomology; infectivity; biological, chemical, and physical properties; techniques for transmission, staining, assay, filtration, and purification; control methods; sources of information; history of virology. II; 1 unit. Prerequisite: Consent of instructor. Offered in 1951-1952 and in alternate years. Thornberry.

417. Discussions in Plant Pathology. Same as Botany 417 and Plant Pathology 417. Required for majors in plant pathology and as elective for graduate students in plant science. I, II; ¼ unit. Staff.

424. Seminar in Plant Virology. Same as Plant Pathology 424. Discussions and concise reports involving a critical analysis, evaluation, and review of original data in the literature with respect to the pathological, biological, physical, and chemical aspects of virus nucleoproteins. I, II; ¼ unit. Thornberry.

447. Vegetable Crops Seminar. Discussion of current literature pertaining to problems of vegetable crops. I; ¼ unit. Huelsen, McCollum, Skok.

448. Vegetable Crops Seminar. Discussion of current literature pertaining to problems of vegetable crops. II; ¼ unit. Huelsen, McCollum, Skok.

461. Pomology Seminar. Discussion of current research and literature in pomology and allied fields. I; ¼ unit. Colby, Lott.

462. Pomology Seminar. Discussion of current research and literature in pomology and allied fields. II; ¼ unit. Colby, Lott.

464. Advanced Small Fruit Culture. Detailed studies of varietal classification, growth, and fruiting habits, and the effects of cultural practices on production. The results of recent research with small fruits both in the station experimental plots and elsewhere are used as a basis for the work. II; ½ to 1 unit. Colby.

466. Fruit Development and Senescence. The anatomy, histology, and physiology of development, maturation, and ripening in fruits and nuts. Discussions and laboratory. Critical analysis of research literature, study and practice of pertinent techniques. Designed as preparation for thesis and other research in this field. II; 1 unit. Prerequisite: Botany 345; Chemistry 132, 133, or 234; consent of instructor. Offered in 1951-1952 and in alternate years. Lott.

491. Thesis. Research on the thesis problem in (a) floriculture, (b) fruit breeding, (c) plant pathology, (d) pomology, and (e) vegetable crops. I; ½ to 4 units. Prerequisite: Twenty hours of undergraduate work in horticulture and allied subjects for a major and twelve hours for a minor. Required of horticulture majors.

492. Thesis. Research on the thesis problem in (a) floriculture, (b) fruit breeding, (c) plant pathology, (d) pomology, and (e) vegetable crops. II; ½ to 4 units. Prerequisite: Twenty hours of undergraduate work in horticulture and allied subjects for a major and twelve hours for a minor. Required of horticulture majors.

493. Research. Research on problems in (a) floriculture, (b) fruit breeding, (c) plant pathology, (d) pomology, and (e) vegetable crops. I; ½ to 4 units. Prerequisite: Twenty hours of undergraduate work in horticulture and allied subjects for a major and twelve hours for a minor. Required in major or minor in horticulture.

494. Research. Research on problems in (a) floriculture, (b) fruit breeding, (c) plant pathology, (d) pomology, and (e) vegetable crops. II; ½ to 4 units. Prerequisite: Twenty hours of undergraduate work in horticulture and allied subjects for a major and twelve hours for a minor. Required in major or minor in horticulture.

Courses for Graduates and Advanced Undergraduates

307. Fruit Diseases. Same as Botany 307 and Plant Pathology 307. Symptomatology; laboratory and field studies of representative diseases; control measures. I; ½ unit. Prerequisite: Botany 317 or 372. Offered in 1951-1952 and in alternate years. Anderson.

308. Vegetable and Canning Crop Diseases. Same as Botany 308 and Plant Pathology 308. Symptomatology; laboratory and field studies of representative diseases; control measures. II; ½ unit. Prerequisite: Botany 317 or 372. Offered in 1950-1951 and in alternate years. Linn.

317. Plant Pathology. Same as Agronomy 317, Botany 317, and Plant Pathology 317. Causes, diagnosis, and treatment of plant diseases. I; ½ unit. Prerequisite: One year of plant science including either Botany 100 and 101, or 104, or 105.

321. Floricultural Physiology. Plant hormones, effect of light, temperature, humidity, and gases on growth of ornamental plants; principles of disease and insect control. Lectures, assigned readings, discussion. I; ½ unit. Prerequisite: Botany 130. Weinard.

322. Plant Nutrition. Soil conditions in relation to the growth of ornamental plants; soil and plant tissue tests, fertilizers and their use; soilless culture; water supplies and automatic watering. Lectures, assigned readings, discussions. II; ½ unit. Prerequisite: Botany 130; Agronomy 201. Weinard.

333. Marketing Horticultural Products. Same as Agricultural Economics 333 and Marketing 333. Producing and consuming areas; transportation; refrigeration; agencies, functions, and channels of distribution; cooperatives; marketing costs and factors affecting prices; standardization, grading, and inspection; marketing news service; perishable agricultural commodity act and other regulations; attempts to control surpluses; canning and other processing; foreign trade; consumer preference and expansion of domestic markets. I; ½ unit. Prerequisite: Agricultural Economics 130, or Marketing 101, or twelve hours of horticulture. Kelley.

343. Structure and Classification of Vegetable Crop Plants. Principles of classification and structure of vegetable crop plants with special reference to their use and production. I; ½ unit. Prerequisite: Botany 100 and 101, or 105. Offered in 1952-1953 and in alternate years.

345. Growth and Development of Vegetable Crops. Factors affecting growth, development, and quality of vegetable crops. Discussions. I; 1 unit. Prerequisite: Botany 130, or consent of instructor. Offered in 1951-1952 and in alternate years. McCollum.

361. Current Horticultural Literature. Assigned topics; review of books, technical journals, and other publications. I; ¼ unit. McCollum.

362. Current Horticultural Literature. Assigned topics; review of books, technical journals, and other publications. II; ¼ unit. McCollum.

379. Research Methods in Plant Pathology. Same as Agronomy 379, Botany 379, and Plant Pathology 379. Lectures and laboratory on the techniques for identification of plant diseases and their causal agents; for evaluation of plant protectants; for the study of the physiology of parasitism, and methods for planning research projects, evaluating data, and preparation of manuscripts for publication. I; ½ unit. Prerequisite: Botany 317. Gerdemann, Gottlieb, Thornberry.

382. Improvement of Horticultural Crops by Breeding. Mechanism of hereditary variations and varietal differentiation in horicultural plants as a basis for determining the method of approach to crop improvement problems, with emphasis on asexually propagated crops. II; ½ unit. Prerequisite: One year of horticulture, or equivalent, exclusive of Horticulture 142 and 161. Offered in 1951-1952 and in alternate years. Birkeland.

HUMANITIES

The Division of the Humanities is composed of the departments of Classics, English, French, German, History, Philosophy, Spanish and Italian, and Speech. It sponsors several courses of interdepartmental interest and purpose, serving the Liberal Arts and Sciences requirement in general education. Its teaching faculty consists of the full-time faculties of the departments listed, of the rank of instructor and above. Professor John T. Flanagan is Chairman of the Division.

Courses for Graduates and Advanced Undergraduates

301. Introduction to Linguistics. Introduction to the science of language. I; 1 unit. Kahane.

Students Working in the Composing Room of the School of Journalism and Communications

JOURNALISM AND COMMUNICATIONS

Graduate work is offered in the following fields: (1) editorial, (2) advertising, and (3) radio. The program of graduate study in these areas is limited to the Master of Science degree. For the program leading to a Ph.D. degree in Mass Communications, see page 88.

Admission to the graduate program is based on the following: (1) Completion of the requirements for a bachelor's degree in an institution of recognized standing, with a major in journalism, English, or the social sciences. A major normally consists of twenty semester credits. (2) A grade-point average of at least 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required courses in physical education and military.

Requirements for the degree of Master of Science include the following:

(1) A major consisting of four units in journalism, and one additional unit approved by the candidate's graduate adviser and the Dean of the Graduate College, including:

(a) For editorial majors, at least two units from the following: Journalism 471, Theory of Communications, Journalism 473-474, Government and Mass Communications. In addition, candidates in this field must have completed the following courses or their equivalent at either the undergraduate or graduate level: Journalism 311, Newspaper Law; Journalism 321, Copyreading; Journalism 323, Advanced Reporting.

(b) For advertising majors, at least two units from the following: Journalism 471, Theory of Communications; Journalism 481, Advanced Advertising Principles; and Journalism 482, Research Methods in Advertising and Communications. In addition, candidates in this field must have completed the following courses or their equivalent at either the undergraduate or graduate level: Journalism 382, Advertising Copy and Layout; Journalism 384, Advertising Campaigns.

(c) For radio majors, at least two units from the following: Journalism 471, Theory of Communications, Journalism 473-474, Government and Mass Communications. In addition, candidates in this field must have completed the following courses or their equivalent at either the graduate or the undergraduate level: Journalism 365, Radio News; Journalism 362, Radio Station Management, or Journalism 386, Radio Advertising; Journalism 368, Radio Regulation.

(2) A minor of at least two units in a subject other than journalism.

(a) For editorial majors, the recommended fields are economics, English, history, philosophy, political science, psychology, and sociology.

(b) For advertising students, the recommended fields are business organization and operation including marketing, economics, home economics, psychology, and sociology.

(c) For radio students, the recommended fields are psychology, economics, sociology, and political science.

(3) A thesis, which may be for one or two units.

(4) A minimum total of eight units.

Fellowships

The International Circulation Managers' Association awards annually two fellowships of $750 each to graduates in journalism who intend to continue their education. Information concerning the fellowships may be obtained from H. Phelps Gates, *Christian Science Monitor,* Boston, head of the association's committee which makes the awards.

Graduate Teaching Faculty

Professors: F. S. Siebert (Director of the School of Journalism and Communications), R. R. Barlow, L. W. Murphy, A. Rae, C. H. Sandage, W. Schramm.

Associate Professors: Q. Howe (Visiting), R. B. Hudson, L. W. McClure, M. D. Seil.

Assistant Professors: D. E. Brown, V. Fryburger, R. Millican, J. T. Trebilcock, N. Wedding.

Instructor: T. B. Peterson.

Courses for Graduates

441. Measurement of Opinion and Attitude. Same as Communications 441 and Psychology 441. Theory and practice in measurement of opinion and attitude formation and change. Attitude scales; factors affecting morale; interpretation of results from social and psychological characteristics of the population; intensity of attitudes; relations among attitudes and opinions. I or II; 1 unit. Prerequisite: Psychology 100; a course in statistics; a course in sociology, social psychology, advertising, or market research. Harrell.

462. Seminar in Radio and Television. Same as Communications 462. A study of the performance of radio and television in terms of content, government and industry controls, social responsibility, economic bases, and psychological and social effects. II; 1 unit. Hudson.

471. Theory of Communications. Same as Communications 471. Nature of the communication process; development of communication patterns and institutions; principles governing the control and support of mass communications; content and audience study; effects of communication; and relation of mass communications to public opinion and group action. I; 1 unit. Schramm.

473. Government and Mass Communications I. Same as Communications 473. Historical background and philosophical bases of freedom of the press. I; 1 unit. Siebert.

474. Government and Mass Communications II. Same as Communications 474. Current legal, constitutional, and administrative problems of media of mass communications; contemporary issues resulting from the restrictive, regulatory, and supplementary activities of government in the field of mass communications. II; 1 unit. Siebert.

481. Advanced Advertising Principles. Same as Communications 481 and Marketing 481. Emphasis is placed on determination and understanding of the principles as related to the science, philosophy, and art of advertising. I; 1 unit. Sandage.

482. Research Methods in Advertising and Communications. Same as Communications 482 and Marketing 482. A critical study of research methods and their applications to the solution of advertising problems. II; 1 unit. Sandage.

491. Research in Special Topics. Thesis. I; 1 to 2 units. Hudson, Sandage, Schramm, Siebert.

492. Research in Special Topics. Thesis. II; 1 to 2 units. Hudson, Sandage, Schramm, Siebert.

Courses for Graduates and Advanced Undergraduates

308. High School Journalism. Journalistic writing in the high school; newspaper study and training of newspaper readers; supervision of school publications and publicity; junior college courses in journalism. II; ½ to 1 unit. Prerequisite: Education 109, or consent of instructor. Brown.

309. Public Relations. Publicity methods and public relations; representation of business and other sponsors to the public and representation of the public to employers. Preparation of public relations units for the press and other media. I; ½ unit. Prerequisite: Consent of instructor. Murphy.

310. Press Systems of the World. Press of England, France, Germany, Italy, Russia, Latin America, China, and Japan; international organization of the press. II; ½ unit. Barlow.

311. Newspaper Law. Freedom of the press; the right to gather, publish, and comment on the news. I, II; ½ to 1 unit. Trebilcock.

320. Editorial Studies and Writing. Writing of editorials and preparation of editorial judgments. Policies for editorials and for the editorial page. I; ½ to 1 unit. Prerequisite: Journalism 212. Barlow.

321. Copyreading. Newspaper desk work; editing the news; correction of faulty news stories; handling wire copy. Attention to headwriting, news pictures, and makeup and design of newspaper pages. I, II; 1 unit. Prerequisite: Credit or registration in Journalism 204; Journalism 212. Rae.

323. Advanced Reporting. Advanced types of news investigation and treatment. I, II; ½ to 1 unit. Prerequisite: Journalism 212, or equivalent. Trebilcock.

328. Industrial Publications. Problems and techniques of editing house organs. II; ½ to 1 unit. Prerequisite: Journalism 211 or 227. Peterson.

343. Newspaper Circulation Problems. Study of the promotion, sales, distribution, and administration problems of the circulation departments of weekly and daily newspapers. I; ½ to 1 unit. Prerequisite: Journalism 241. Rae.

351. Graphic Production Processes. Detailed study of the preparation of copy and illustrative material for the mass production of news, features, and advertising; comparison of quality and costs of production processes; consideration of personnel, equipment, and raw materials entering into graphic production. Field trips to Danville and Chicago; approximate cost to student, $15. I, II; ½ to 1 unit. Prerequisite: Journalism 204. Seil.

362. Radio Station Management. A study of the organization and administration of the radio staff and station. Public relations, personnel management, and station operation. Analysis of station and agency relationships and radio station procedure. Methods and media for program and station promotion. Regulations affecting management, financing, and labor relationships. II; ½ unit. Prerequisite: Journalism 261. Schooley.

365. Radio News. News writing and editing for broadcasting; radio news style; preparation and practice for special event reporting; commentaries and interpretations; radio news services, and processing radio news service copy. I, II; ½ to 1 unit. Prerequisite: Journalism 212. Brown.

366. Advanced Radio Practices I. Project work for advanced students in selected areas of radio, including radio news, radio advertising, radio announcing, radio production and direction, and radio writing. I; ½ unit. Prerequisite: All courses in area of specialization; consent of instructor. Hudson and staff.

367. Advanced Radio Practices II. Project work for advanced students in selected areas of radio, including radio news, radio advertising, radio announcing, radio production and direction, and radio writing. II; ½ unit. Prerequisite: All courses in area of specialization; consent of instructor. Hudson and staff.

368. Radio Regulation. Federal legislation, with emphasis on the Communications Act of 1934 and the regulations of the Federal Communications Commission, legal problems in program operations, censorship and editorial selections, copyright, and author-producer relations. II; ½ unit. Siebert.

382. Advertising Copy and Layout. Same as Marketing 382. Theory and practice of advertising copy writing and layout for newspaper, magazine, and direct mail; advertising planning for the local advertiser; use of consumer and market surveys, copy-testing methods, and advertising readership studies. I, II; 1 unit. Prerequisite: Journalism 204 and 281. Millican.

383. Advertising Media. Same as Marketing 383. Analysis of the various advertising media in terms of markets served and factors to consider in the selection of media. I, II; ½ unit. Prerequisite: Journalism 281. Fryburger.

384. Advertising Campaigns. Same as Marketing 384. Planning and execution of an advertising campaign; market and consumer research; development and allocation of advertising budget, organization and functions of advertising agency, choice of advertising appeals; selection of media; preparation of advertisements — copy and layout. I, II; ½ to 1 unit. Graduate students will not receive credit for both Journalism 384 and 387. Prerequisite: Journalism 382 and 383. McClure, Wedding.

385. Advertising Promotion and Sales. Same as Marketing 385. Sales problems, advertising promotion, advertising research, market research. I, II; ½ to 1 unit. Prerequisite: Journalism 382. McClure.

386. Radio Advertising. Same as Marketing 386. Economics, standards, and ethics as applied to radio commercials; sponsorship, rates, and advertising techniques, including merchandising, marketing, servicing, and sales; preparation and presentation of radio advertising copy, measurements, and listener surveys. I, II; ½ unit. Prerequisite: Journalism 281. Sandage.

387. Advertising Policies and Problems. Same as Marketing 387. Analysis of actual advertising situations and study of how such situations were or might have been met. Consideration given to management and technical problems at both the national and retail levels. I, II; ½ to 1 unit. Graduate students will not receive credit for both Journalism 384 and 387. Prerequisite: Journalism 281. Wedding.

LABOR AND INDUSTRIAL RELATIONS

The Institute offers a degree of Master of Arts in Labor and Industrial Relations through an integrated curriculum of the social sciences which apply to this field. Institute courses are also available to the student working for the Master of Arts, Master of Science, or Doctor of Philosophy degrees in other departments of the University.

Students applying for admission must have a grade-point average of at least 3.75 for that portion of the work which represents the last fifty per cent of the hours earned toward the bachelor's degree exclusive of required courses in physical education and military training. Students on limited status will not be admitted.

The Institute's study program is based on the student's need for an understanding of the broad social and economic factors shaping our industrial society, some degree of specialization in one of five areas of study, and practical experience in the field. Areas of study in the Institute are: Human Relations in Industry, Labor Economics, Labor Union Organization and Administration, Labor and Government, and Personnel Management.

Students will be admitted to the Institute on approval of the Director and upon meeting these prerequisites: a minimum of twenty-one hours in the social sciences, of which nine should be in economics. Other social sciences include history, philosophy, political science, psychology, and sociology. At least three hours credit in statistics and three hours credit in labor economics or labor problems are to be included in the total of twenty-one hours.

Students who can not meet these special course prerequisites may register for graduate work, but must remove any deficiency during the first year of residence by taking the prescribed courses without graduate credit, unless exempted for reasons satisfactory to the adviser in charge.

A candidate for the Master of Arts degree in Labor and Industrial Relations must complete eight units of graduate credit including: one unit in the Research Seminar in Labor and Industrial Relations (Labor and Industrial Relations 493), five units to be selected from appropriate courses in the principal areas of study listed above, and two units devoted to the writing of a thesis, the subject of which must be approved by the Director of the Institute.

With the approval of the Institute, courses to meet the five-unit requirement may also be selected from those offered in other departments of the University.

In addition to the eight units described above, the candidate for the master's degree is required to work for a minimum of three months in industry in the status of an employee. The student must show — through oral and written examinations — that he has learned some of the practical problems involved in employer-employee relationships, and how various solutions of these problems affect the employee, the employer, the industry, and the community outside the plant. Work experience undertaken previous to graduate work in the Institute may, if approved, be submitted to meet this requirement.

Full details of the Institute program are given in the bulletin "Graduate Study in Labor and Industrial Relations" which may be obtained by writing to the Institute of Labor and Industrial Relations, 704 South Sixth Street, Champaign, Illinois.

Assistantships

The Institute offers graduate assistantships to students whose undergraduate records and work experience are superior. These awards pay not less than $1,200 (plus tuition) for the academic year. The work requirement is twenty hours a week. Institute research projects, information service, and extension programs provide valuable practical experience to supplement classroom instruction. For full details see the Institute bulletin "Graduate Study in Labor and Industrial Relations." Application forms may be secured by writing directly to the Institute.

Graduate Teaching Faculty

Professors: W. E. Chalmers (Director of the Institute of Labor and Industrial Relations), M. Derber, P. L. Garman, E. B. McNatt, W. H. McPherson, L. L. McQuitty, R. Stagner.

Associate Professors: J. B. Parrish, L. C. Pigage.

Assistant Professors: M. K. Chandler, J. M. Edelman, M. A. Horowitz, D. E. Wray.

Instructor: G. Y. Steiner.

Courses for Graduates

418. Seminar in Human Relations in Industry. Same as Sociology 418. Individual research in sociological interpretation of industrial organization; the orientation and motivation of the individual in industry and commerce; labor-management relations as group adjustments; the interrelations of industry and the community. I; 1 unit. Prerequisite: Six hours of sociology including Sociology 318, or consent of instructor. Wray, Dubin.

420. Formation of Public Policy. Same as Political Science 420. An examination of the institutional and dynamic forces that shape the making of policy and its administration in the United States; separation of powers, pressure groups, administrative and legal procedures, and judicial activity. I or II; 1 unit. Hagan.

440. Labor Economics. Same as Economics 440. A critical economic analysis of contemporary English and American wage theory, employment and unemployment, and collective bargaining, with emphasis on public policy. I; 1 unit. Prerequisite: Six hours of economics. McNatt.

441. Labor Economics. Same as Economics 441. A critical economic analysis of contemporary English and American wage theory, employment and unemployment, and collective bargaining, with emphasis on public policy. II; 1 unit. Prerequisite: Six hours of economics. McNatt.

442. Problems and Practices in Collective Bargaining. Same as Economics 442. Seminar in the methods and techniques of collective bargaining in the negotiation of the labor contract; nature and significance of labor agreements; union, management, and public interests in major contract provisions. I; 1 unit. Prerequisite: Consent of instructor. McPherson.

443. Problems and Practices of Labor Dispute Settlement. Same as Economics 443. Seminar in the techniques of labor contract administration; comparative study of grievance procedure operation; analysis of conciliation, fact-finding, and arbitration procedures, including case studies of arbitration awards. II; 1 unit. Prerequisite: Consent of instructor. McPherson.

446. Trade Unions and the Economy. Same as Economics 446. The economic significance of trade unionism: the role of unions as economic policy-making institutions; basic economic criteria in union-management negotiations; union policies and changing technology; unions and social security issues; effect of trade union policies and practices on the functioning of a competitive system. I; 1 unit. Prerequisite: Six hours of economics. Parrish.

447. Labor Union Organization and Administration. Same as Economics 447. Analysis of the structure and government of the modern American trade union movement with particular reference to the relation between organization and function. Problems relating to the function and execution of economic policies, the maintenance of unity and discipline, the adjustment of jurisdictional conflicts, and the observance of agreements will be examined and appraised. II; 1 unit. Prerequisite: Major in social sciences, or consent of instructor. Chalmers.

448. Problems of Personnel Administration. Same as Management 448. An examination of the organization and administration of the personnel function in management. The course will deal with the relations of personnel administration to operating departments, and the scope of business and industrial personnel services. Analytical appraisal of policies and practices in selected areas of personnel administration, such as selection and training,

will be carried out through case studies and direct industrial contacts. Specific consideration will be given to problems up to and including placing the person on a job. I; 1 unit. Prerequisite: Economics 248, or equivalent; consent of instructor. LOKEN.

449. PROBLEMS OF PERSONNEL MANAGEMENT. Same as Management 449. A seminar and laboratory course dealing with the problems and practices encountered by personnel managers subsequent to the employment process. Students will do field work in businesses and industries in the area on such topics as incentives, rating, employee services, and community relations. II; 1 unit. Prerequisite: Economics 240, 248, and Management 301, or Labor and Industrial Relations 448. LOKEN.

457. PSYCHOGENICS OF INDUSTRIAL CONFLICT. Same as Psychology 457. Offers an opportunity for advanced study, through readings in current literature, lectures, field projects, and visiting speakers, of the psychological origins of industrial conflict. Theoretical analysis of the perceptions, emotions, motives, and frames of reference of managerial executives, workers, and union officials will be supplemented by visits to industrial enterprises and union headquarters. Each student will be required to do an intensive library and field study of some specific problem in labor-management relations. II; 1 unit. Prerequisite: Psychology 357; consent of instructor. STAGNER.

491. THESIS SEMINAR. For all students writing theses in labor and industrial relations. I; ½ to 2 units. STAFF.

492. THESIS SEMINAR. For all students writing theses in labor and industrial relations. II; ½ to 2 units. STAFF.

493. RESEARCH SEMINAR IN LABOR AND INDUSTRIAL RELATIONS. Systematic analysis of theories and procedures of the various social and physical sciences bearing on research in labor and industrial relations. Although the experience of students, including term papers and theses in process, will be utilized, primary emphasis will be on the process of integrating the approaches and techniques of all the social sciences with respect to the study of problems in labor and industrial relations as met in practice in management, the union, and government service, as well as in teaching and research in the field. I, II; 1 unit. Prerequisite: Major in social sciences, or consent of instructor. DERBER.

Courses for Graduates and Advanced Undergraduates

312. PROBLEMS OF ADMINISTRATION AND ORGANIZATION. Same as Management 312. Problems of the individual and groups brought about by modern industrial organizations and techniques. Motivations for work and cooperation between executives and different economic and social groups. I, II; ½ unit. Prerequisite: Management 101, or equivalent. DUBIN.

318. HUMAN RELATIONS IN INDUSTRY. Same as Sociology 318. Sociology of industry and problems of personal adjustment. The emergence of modern industrial and labor organizations and their impact upon community life. I, II; ½ to 1 unit. Prerequisite: Psychology 100, Sociology 100, or consent of instructor. CHANDLER, DUBIN, WRAY.

342. ECONOMICS OF SOCIAL SECURITY. Same as Economics 342. A critical analysis of the economic issues and problems involved in our legislative efforts to reduce the economic risks of unemployment, old age dependency, and industrial injury. I; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108. MCNATT.

343. The Labor Market. Same as Economics 343. Economic analysis of the labor market, its structure, characteristics, and operations in contrast with other markets; factors making for equilibrium and disequilibrium; migration; occupational and industrial mobility; labor market research including techniques and materials. II; ½ to 1 unit. Prerequisite: Economics 102 or 108; Economics 240. Parrish.

344. The Law and Labor. Same as Economics 344. An economic analysis of the problems and issues arising out of the legislative and judicial efforts to define the rights, duties, and responsibilities of labor organizations and management in the field of industrial relations. II; ½ to 1 unit. Prerequisite: Economics 102 and 103, or 108; Economics 240. McNatt.

346. Foreign Labor Movements. Same as Economics 346. Analysis of the history, organization, economic policies, political programs, and domestic, international, and contemporary influence of the labor movements of Great Britain, Sweden, Germany, France, Latin America, and Russia. I; ½ to 1 unit. Prerequisite: Economics 240. Chalmers.

357. Psychology of Industrial Conflict. Same as Psychology 357. Presents an analysis, in terms of the behavior of individuals, of the causes and possible solutions of industrial conflict. Motives, emotions, attitudes, and ways of perceiving situations are considered in relation to the actions of industrial executives, factory workers, and union leaders. Results of factory observation, public opinion polls, laboratory experimentation, and psychoanalysis are integrated to provide a systematic interpretation of the problem, and to evaluate proposed actions toward a solution. I or II; ½ to 1 unit. Prerequisite: Psychology 100, or equivalent, and one of the following: Psychology 145, or Economics 240, or Sociology 318. Stagner.

365. Administration of Federal Labor Law. Same as Political Science 365. Role of administration in the effectuation of public policy; organization and procedures of major federal labor agencies; types of policies formulated by federal labor agencies; experience of bureaus of Department of Labor, National Labor Relations Board, United States Employment Service, National Mediation Board, War Labor Board, and others. I or II; ½ to 1 unit. Prerequisite: Political Science 150. Edelman.

368. Public Personnel Administration. Same as Political Science 368. An analysis of personnel management in government. Such questions as recruitment and selection, job and salary classification, work standards, training, and the role of labor and professional organizations in the public service will be considered in the light of current theory and practice. I or II; ½ to 1 unit. Prerequisite: Political Science 361, or consent of instructor. Durisch.

380. Labor Law. Same as Law 380. The law of industrial relations with special emphasis on recent cases and legislation; collective bargaining and labor contracts; wages and hours legislation; unemployment compensation. II; 1 unit. Sullivan.

LANDSCAPE ARCHITECTURE

(Including City Planning)

The Department of Landscape Architecture offers graduate work leading to the Master of Arts and Master of Science degrees only. Students applying for admission must have a grade-point average of at least 3.5 for that portion of the

work which represents the last fifty per cent of the hours earned toward the bachelor's degree, exclusive of required courses in physical education and military training. Students on limited status will be admitted.

Master of Arts in Landscape Architecture. The prerequisite for graduate work in landscape architecture is a bachelor's degree in landscape architecture substantially equivalent to the degree conferred by the University of Illinois.

To qualify for this degree a student must take the seminar and thesis course for four units, and at least four additional units chosen from the following:

	UNITS
Architecture (advanced undergraduate courses in design or history)	1
Botany (advanced undergraduate or graduate courses)	1
Civil Engineering 423 — Highway Traffic, Transport, and Safety	1
Landscape Architecture 436 — Landscape Design	1 to 2
Landscape Architecture 447 — Landscape Construction	1 to 2
Landscape Architecture 457 — Advanced Planting Design	1 to 2

Master of Science in City Planning. College graduates in architecture, civil engineering, landscape architecture, and the social sciences are offered an opportunity to prepare themselves for careers in city, state, and regional planning. After completing their preparation they will be qualified for positions with city, metropolitan, state, and regional planning commissions and with planners in independent practice.

The prerequisite for graduate work in city planning is a bachelor's degree in architecture, civil engineering, landscape architecture, or the social sciences, and must include courses of the following character or their acceptable equivalent:

	HOURS
City and regional planning (introductory)	4
Sociology (urban, rural or regional)	3
Political Science (municipal government and problems: public administration)	3
Economics (theory and practice of modern economic society; urban land economics; public finance)	3
Design (skill in graphic expression and techniques of spacial design; landscape or architectural design or highway and municipal design; regional design)	12

To qualify for this degree a student must take the seminar and thesis course for four units and at least four additional units. In the latter connection attention is called to the courses in city planning design in the College of Fine and Applied Arts; highway engineering, highway traffic, transport, and safety, airport design, water resources and development, water supply, and municipal engineering in the College of Engineering; public finance, economics of transportation and of public utilities in the College of Commerce and Business Administration; urban and area geography, municipal administration, state government, public opinion, sociology of the community, rural sociology, educational administration in the College of Liberal Arts and Sciences. With proper authorization the student may make selection from these or other graduate courses having a close relationship to the city planning field.

Graduate Teaching Faculty

Professors: O. G. Schaffer (Head of Department), H. Bartholomew, K. B. Lohmann, F. B. Robinson, S. H. White.

Courses for Graduates

436. Advanced Landscape Design. Landscape design of large private, semi-public, and public properties. I, II; 1 to 2 units. White.

437. City Planning Design. Analysis and synthesis of problems and possibilities in the layout of average towns and cities and their surroundings. I, II; 1 to 2 units. Prerequisite: Enrollment for master's degree in City Planning. Lohmann.

447. Advanced Landscape Construction. Construction problems connected with large private and public landscape developments. I, II; 1 to 2 units. Schaffer.

457. Advanced Planting Design. Theory and application of planting design in relation to private, semi-public, and public properties. I, II; 1 to 2 units. Robinson.

487. Seminar. I; ½ unit. Lohmann and others.

488. Seminar. II; ½ unit. Lohmann and others.

491. Thesis. I; 1½ units. Staff.

492. Thesis. II; 1½ units. Staff.

LAW

Beginning in the fall of 1951, the College of Law will offer work leading to the degrees of Master of Laws (LL.M.) and Doctor of the Science of Law (J.S.D.). To be eligible for admission to these programs, the applicant must be a graduate of the College of Law of the University of Illinois or of a law school having similar graduation requirements. The undergraduate law work must have been of sufficiently high quality to indicate an ability to do satisfactory work at the graduate level.

One academic year in residence is required of a candidate for either degree. The programs consist of course work and research which have been approved by the Committee on Graduate Study of the College of Law. In addition to the course work and research, a thesis is required for the master's degree, and this thesis may be completed during the year of residence. A candidate for the degree of Doctor of the Science of Law devotes his residence year primarily to research. A dissertation which is a significant contribution to legal literature is required for this degree and must be presented to the faculty in not less than one year nor more than five years after the completion of the year in residence. An oral examination before a committee of the faculty is required of candidates for this degree.

Details may be obtained from the Dean of the College of Law.

LIBRARY SCIENCE

The purpose of the Library School is to prepare young men and women for careers as professional librarians in all types of libraries. Programs of study may be followed leading to the master's degree and the doctor's degree in Library Science.

Following suitable undergraduate preparation in general educational subjects as well as professional library courses, a fifth year of advanced professional study, combined with some advanced non-library studies, leads to the degree of Master of Science in Library Science. This degree represents the minimum academic preparation for professional librarianship.

Experienced librarians of marked professional capacity and promise may pursue a program of advanced study and research leading to the degree of

Doctor of Library Science. The normal minimum period of study is the equivalent of two years beyond the master's degree.

Students holding bachelor's degrees from any accredited institution but without previous course work in library science are eligible for admission to the master's program upon completion of a portion of the pre-graduate professional core. Normally, this may be accomplished in any regular summer session.

Students holding bachelor's degrees from any accredited four-year or five-year library school may be admitted directly to the master's program without further course work.

Degree of Master of Science in Library Science. In addition to the regular requirements for admission to the Graduate College, the student must also fulfill the following minimum requirements before he will be permitted to register for advanced work in library science.

(1) A grade-point average no lower than 3.5 (C+) for that portion of undergraduate work representing the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training.

(2) Successful completion of a preparatory professional program in an accredited library school, either graduate or undergraduate, or equivalent training satisfactory to the Library School; or

(3) Successful completion of a basic core of three professional courses offered by the Library School each summer session of eight weeks. A scholastic average of at least 3.5 (C+) must be made in these courses.

(4) Successful completion of a basic introductory course in each of the following subjects: sociology, psychology, education, American government, public administration, and economics. An elementary course in statistics is recommended for all graduate students and will be required of students who wish to enter the doctoral program.

If deficiencies occur, the Library School, after evaluation of the student's undergraduate program, will indicate which courses, if any, must be cleared before admission. It is possible for some deficiencies to be made up after conditional admission to the Graduate College.

(5) A reading knowledge of one modern foreign language. Students specializing in bibliographical work and in college or university library administration must have a reading knowledge of at least two foreign languages and statistics.

(6) Evidence of ability to pursue graduate work in library science.

All students whose undergraduate professional training was completed at institutions other than the University of Illinois will be given, at the beginning of the semester in which they enter, a placement examination in the basic principles and techniques of librarianship. The results of this examination will be used in determining the student's program of study.

Correspondence regarding admission should be addressed to the Assistant Director of the Library School from whom the detailed Library School Announcement and the necessary application blanks can be secured. All applications, transcripts, and other necessary papers should be filed as early as possible, and not later than four weeks before the date of registration. No student should complete his plans for attending the Library School until he has been notified of his admission.

At least two semesters in residence or the equivalent, and the completion of nine units of graduate work are required. Four to five units constitute a normal semester program for the master's degree. A student who receives two units of a grade below "B" during his first year of graduate work may not complete the residence requirements in one year by carrying the minimum program of nine units for the master's degree. Three units of a grade below "B" disqualify a student as a candidate for a degree.

No thesis is required but each student will designate one of his regular course papers as his master project. The subject of this paper will be determined by the student and approved by the instructor of the course in which it is to be written. The title of the paper is to be filed in the Library School office not later than two weeks after the start of the semester in which the student expects to graduate. Two typewritten copies of this report are to be prepared, one for the instructor of the course and the other to be deposited in the Office of the Assistant Director of the Library School not later than two weeks before the date on which the degree is to be conferred.

No courses are required, but each student's program of study will be developed for his particular needs and purpose. At the time of registration each student will be assigned an adviser from the Library School faculty. As the first step in registration, the student, in consultation with his adviser, will decide upon his program for at least the first semester. Governed by his previous training, the student will be encouraged to take a portion of his course work outside the Library School.

Degree of Doctor of Library Science. A student desiring to pursue a program of study and research leading to the degree of Doctor of Library Science must meet the customary admission requirements of the Graduate College. In addition, he must meet the following requirements of the Library School:

(1) A master's degree in library science from an accredited library school or an equivalent acceptable to the Library School.

(2) A substantial period of acceptable professional library experience.

The normal minimum period of study required for the degree of Doctor of Library Science is two years beyond the master's degree, during which the student is required to devote all his working time to studies. All three years must be spent in resident graduate study at some accredited educational institution, and either the first two or the last one of the three must be spent at the University of Illinois. The degree is conferred, however, not for residence during a certain period, but for scholarly attainments and power of investigation, as proved by a thesis and examinations.

The remaining general requirements for this degree in respect to residence, language requirements, academic program and thesis are the same as that for the Doctor of Philosophy degree.

Fellowships and Assistantships

The Katharine L. Sharp Fellowship was endowed in 1933 by the Illinois Library School Alumni Association as a memorial to the founder of the School. It is awarded on recommendation of the faculty. The stipend is $600 and exemption from tuition.

Several assistantships in the University Library and in the Library School are open each year to properly qualified candidates. Graduate students in the Library School who have completed the bachelor's degree with eighteen hours of library science or its equivalent are eligible for part-time academic appointments to the Library staff. Appointments are made for one year and may be renewed once. Half-time appointments require twenty hours of work each week at duties assigned by the Director of the Library and Library School; three-quarter time appointments require thirty hours. The minimum stipend for a half-time assistantship is $1,300 a year; for a three-quarter time appointment, $1,950.

Graduate Teaching Faculty

Professors: R. B. Downs (Director of Library School), A. H. Lancour (on leave 1950-1951).

Associate Professors: L. E. Bamber, T. Eaton, H. Goldhor, Josie B. Houchens, A. M. McAnally, Rose B. Phelps (on leave 1950-1951).

Assistant Professors: Marie M. Hostetter, M. Alice Lohrer, C. W. Stone.

Courses for Graduates

401. Communications. An introduction to the study of the mass media of communications (print, broadcasting, films) in modern society. Basic problems, studies, and principal techniques in communications research are considered from the viewpoint of the librarian. I; 1 unit. Prerequisite: Completion of undergraduate library core, or equivalent.

402. The Reading of Adults. Designed to acquaint the student with the evidence on the nature of materials read by adults, on reading habits, and on the effects of reading. II; 1 unit. Prerequisite: Library Science 401.

404. The Reading of Young People. Concerned primarily with the major areas of research in the field of reading for young people. Class discussions are devoted to a critical analysis of these studies and their implications for the librarian working with children and young people. II; 1 unit. Prerequisite: Library Science 401. Lohrer.

405. Library Administration. Designed to give the student a knowledge of the internal organization of various types of libraries and of the principles of library administration. The emphasis of the course is on the comparison of the conditions found in various types of libraries and on the application to libraries of the general theory of administration. I; 1 unit. Prerequisite: Completion of undergraduate library core, or equivalent. Lancour.

407. Cataloging and Classification, I. The theory, practice, and application of the principles of cataloging and classification. Emphasizes subject cataloging and the more complex types of cataloging entry. Problems provide drill in the use of Dewey Decimal and Library of Congress classification schemes and the Library of Congress Subject Readings. I; 1 unit. Prerequisite: Completion of undergraduate library core, or equivalent. Eaton.

408. Cataloging and Classification, II. The theory, practice, and application of the principles of cataloging and classification. The cataloging and classification of special types of materials, including maps, music, films, slides, phonograph records, incunabula, and other rare items. Includes some discussion of the administrative problems of the cataloging department. II; 1 unit. Prerequisite: Library Science 407. Eaton.

410. Teaching Function of the Library. A study of the implications inherent in the concept of the library as an educational institution. A consideration of this concept as the source of a philosophy of librarianship. Study will be made of outstanding applications in the profession. II; 1 unit. Stone.

411. Bibliography of the Humanities and Social Science. Detailed study of the basic and most useful reference and bibliographic aids. Drill and practice in the use of specific titles will be given, but emphasis will be placed on understanding the uniform pattern of reference tools that exists in each of the major fields of the humanities and the social sciences. I; 1 unit. Prerequisite: Completion of undergraduate library core, or equivalent. Phelps.

412. Bibliography of Science and Technology. Detailed study of the basic and most useful reference and bibliographic aids. Drill and practice problems

in the use of specific titles will be given, but emphasis will be placed on understanding the uniform pattern of reference tools that exists in each subject field. II; 1 unit. Prerequisite: Completion of undergraduate library core, or equivalent. PHELPS.

425. METHODS OF INVESTIGATION. The elements of scientific investigation with emphasis on the principal methods of research applicable to the problems of librarianship. The course is designed to prepare producers, not consumers of research. Knowledge of elementary statistical methods is prerequisite for admission. I; 1 unit. GOLDHOR.

426. DEVELOPMENT OF THE LIBRARY CATALOG. The history and philosophy of classification schemes and cataloging codes, and a comparative study of present day cataloging practices. II; 1 unit. Prerequisite: Library Science 407. EATON.

427. RESOURCES OF AMERICAN LIBRARIES. The aims of this course are to acquaint the student with the distribution and extent of American library resources for advanced study and research; methods of surveying library facilities; growth and use of union catalogs and bibliographical centers; inter-institutional agreements for specialization of collections and other forms of library cooperation; types of library materials; and ways and means of developing research collections in special subject fields. I; 1 unit. DOWNS.

428. THE PHYSICAL PROBLEMS OF LIBRARIES. Consideration of the principles and problems of the construction, remodeling, and equipment of the main types of libraries, with emphasis on their interrelationships, administrative implications, and recent developments. II; 1 unit. GOLDHOR.

429. GOVERNMENT PUBLICATIONS. The nature and scope of American and British government publications; the problems of their organization because of form, production, and distribution. I; 1 unit. PHELPS.

430. ADVANCED REFERENCE SERVICE. Designed to enable the student to utilize the varied resources of a large research library; methods of analyzing and solving bibliographic problems such as arise in scholarly libraries and in connection with research projects. II; 1 unit. Prerequisite: Library Science 429.

431. LARGER UNITS OF LIBRARY ORGANIZATION. Study of library cooperation, library contracts, county and regional libraries, and other devices for the provision of school and public library service by units serving more than a local area. Emphasis is on the legal and administrative aspects in the large and not on the details of operational procedures. I; ½ to 1 unit. GOLDHOR.

432. HISTORY OF BOOKS AND PRINTING. The origin and evolution of the alphabet and of scripts; the history of manuscript books; the invention and spread of printing; the history of the production and distribution of printed books; the history of ancient and medieval libraries in relation to the collection and preservation of books. Emphasis is placed on the relation of the book to the social conditions of the various periods studied. II; 1 unit. HOUCHENS.

433. BIOLOGICAL LITERATURE AND REFERENCE WORK. An introduction to the use of indexes and abstract journals in the biological sciences and related fields. Use of general library aids, preparation of scientific manuscripts, and history of scientific societies are also considered. I, II; ¼ unit. Prerequisite: Consent of instructor. BAMBER.

451. Problems in Reference Service. Designed to examine the assumptions on which the interpretation of library resources is based, to consider the objectives of such a service and the policies which will lead to their attainment. I; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent. Phelps.

452. Education for Librarianship. A study of the development of library education in this country and abroad. Not a course in teaching method but designed to provide an understanding of the philosophical foundations of the several training agencies through an analysis of their methods, content, character of personnel, and relationship to the profession at various times. II; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent. Lancour.

453. Problems in Cataloging and Classification. An analysis of the major technical and organizational problems of cataloging and classification. Not a course in methods but the careful study of the best and latest thinking through reading and discussions of the persistent problems in this area of librarianship. Individual studies on selected topics. I; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent. Eaton.

454. College and University Library Problems. Analysis and investigation of administrative and educational problems in college and university libraries. II; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent. McAnally.

455. Studies in Reading. Critical analysis of the assumptions and problems of the reading process of young people and adults with reference to its applications to library work. I; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent. Stone.

456. Public Library Problems. Critical analysis of the major problem areas in the administration and organization of public libraries. II; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent. Goldhor.

457. Librarianship and Society. The emphasis of this course is on the place of libraries today as a social institution and in relation to social trends. Consideration is given to the role of the librarian as an individual and as a professional worker in contemporary society. I; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent. Eaton.

458. School Library Problems. A critical analysis of the current practices and major problems confronting the school library field. II; 1 unit. Prerequisite: Master of Science degree in library science, or equivalent. Hostetter.

491. Thesis. Individual study and research for doctoral candidates. I; 1 to 4 units. Downs, Eaton, Goldhor, Lancour, Phelps.

492. Thesis. Individual study and research for doctoral candidates. II; 1 to 4 units. Downs, Eaton, Goldhor, Lancour, Phelps.

Courses for Graduates and Advanced Undergraduates

301. Literature of the Humanities and Social Sciences. The purpose of this course is to increase the student's knowledge of the scope and significant characteristics of the literature of the social sciences and the humanities, by systematic study of modern trends, themes, and representative materials. Provides an introduction to each field, and emphasizes development of skills in selection in relation to library problems and processes. I; 1 unit. Stone.

302. Literature of Science and Technology. A survey of the several fields of pure and applied science and a study of the literature of each field. Designed to give the student an understanding of the content of each of the scientific disciplines and its role and place in modern society. Selected readings from the outstanding works in each field will acquaint the student with the principal sources. II; 1 unit. Stone.

303. Library Materials for Children. The selection and use of library materials for children in public and school libraries according to the needs of the child in his physical, mental, and emotional development, and the purposes of the elementary school program. The student becomes acquainted with the standard book selection aids for children and with all types of printed and audio-visual materials, and develops the ability to select and describe children's library materials according to their developmental uses. I, II; 1 unit. Hostetter, Lohrer.

304. Library Materials for Adolescents. The selection and use of library materials for adolescents in school and public libraries and community organizations. The course aims to develop the ability to select and evaluate a wide variety of reading materials from standard bibliographies for the adolescent according to his personal and school needs. I, II; 1 unit. Hostetter, Lohrer.

306. Maps and Cartobibliographical Aids. An examination of the problems involved in the cataloging, classification, and care of maps. The student will become acquainted with the major cartobibliographical and related aids in the field. II; ½ unit. Ranz.

MATHEMATICS

The Department of Mathematics offers graduate work leading to the degrees of Master of Arts or Master of Science and Doctor of Philosophy. Research for the doctor's degree can be carried out in the fields of algebra, analysis, applied mathematics, geometry, and statistics.

For admission to full status, a beginning graduate student must have a grade-point average not less than 3.5 for that portion of his undergraduate work representing the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students will be admitted on limited status.

Students beginning graduate study with a major in mathematics must have had twenty hours of undergraduate work in mathematics besides the usual freshman courses in algebra, trigonometry, and analytic geometry, including a one-year course in calculus and one year of more advanced work in one or more of the fields of algebra, analysis, and geometry.

Candidates for a Doctor of Philosophy degree taking a first minor in mathematics are expected to have completed a course in calculus and are required to take two one-year courses beyond the calculus. Those taking a second minor are required to complete at least one course throughout a year beyond the calculus.

The more technical courses offered by the Department are arranged mainly in cycles of two or of three years, so that a properly qualified student will usually have opportunity to take any particular course at some time during the three years of residence required for the doctor's degree.

Candidates for the degree of Master of Science in the Teaching of Mathematics must earn four units in mathematics (two units of which are electives), two units in education, and two units in electives. Requirements are Mathematics 317 or 327, one unit; Mathematics 318 or 328, one unit; two of the following

courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit. The elective courses in mathematics and the other electives must be selected with the approval of the adviser. The electives may be in mathematics, in education, or, in exceptional cases, in other fields. Students applying for admission must have the same grade-point average as that required by the Department. Students on limited status will not be admitted to this program. The adviser for candidates for this degree is Professor H. R. Brahana, 357 Mathematics Building.

Candidates for the degree of Master of Science in the Teaching of Mathematics and the Physical Sciences must earn two units in mathematics, one unit in chemistry, one unit in physics, two units in education, and two units in electives. Requirements are Mathematics 347 or 343, one unit; Mathematics 348 or 345, one unit; Chemistry 240, Physical Chemistry, one unit; Physics 322, Theoretical Mechanics, one unit; two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit. The electives may be in mathematics, in education, in chemistry, or in physics. Students applying for admission must have a grade-point average of at least 3.5 for that portion of work which represents the last fifty per cent of the hours earned for the bachelor's degree, exclusive of required courses in physical education and military training. Students on limited status will not be admitted. The adviser for candidates for this degree is Professor H. R. Brahana, 357 Mathematics Building.

A departmental pamphlet giving added details regarding the graduate program is in preparation. When it is complete, it may be secured from the office of the Department.

Assistantships

Graduate assistantships are available for a limited number of highly qualified degree candidates. The Department does not approve teaching loads in excess of half time for assistants. Inquiries and requests for application forms should be addressed to the Department of Mathematics.

Graduate Teaching Faculty

Professors: S. S. Cairns (Head of Department), R. Baer, D. G. Bourgin, H. R. Brahana, M. M. Day, J. L. Doob, P. W. Ketchum, W. G. Madow, H. J. Miles, T. Nakayama (Visiting, 1950-1951), A. H. Taub, W. J. Trjitzinsky.

Associate Professors: G. P. Hochschild, H. Levy, C. W. Mendel, J. W. Peters.

Assistant Professors: Beulah M. Armstrong, W. F. Atchison (on leave 1950-1951), P. Bateman, C. R. Blyth, O. K. Bower, Josephine H. Chanler, H. Chernoff, W. A. Ferguson, M. K. Fort, Jr., V. A. Hoersch, F. E. Hohn, J. Landin, H. Lass, B. E. Meserve, Josephine M. Mitchell, M. E. Munroe, Echo D. Pepper, I. Reiner, L. Schoenfeld, E. J. Scott, L. L. Steimley, H. E. Vaughan, W. Wilson.

Instructors: M. D. Davis, Corinne R. Hattan, M. Jerison, R. G. Langebartel (on leave 1950-1951), C. A. Phillips, Jewell E. Schubert.

Courses for Graduates

401. Theory of Fields. I; 1 unit. Prerequisite: Mathematics 317 and 318, or equivalent. Landin.

402. Linear Algebra. I; 1 unit. Prerequisite: Mathematics 317 and 318, or equivalent. Brahana.

403. Theory of Rings. I or II; 1 unit. Prerequisite: Mathematics 317 and 318, or equivalent.

404. Group Theory. II; 1 unit. Prerequisite: Mathematics 317 and 318, or equivalent. Reiner.

405. Commutative Ideal Theory and Valuations. I; 1 unit. Prerequisite: Two graduate courses in algebra, including Mathematics 401. Hochschild.

406. Algebraic Number Theory. I or II; 1 unit. Prerequisite: Mathematics 353, 354, and 405.

407. Representation Theory and Classical Groups. I or II; 1 unit. Prerequisite: Mathematics 317 and 318, or equivalent.

408. Lie Groups. I; 1 unit. Prerequisite: Mathematics 332, 404, and 441. Hochschild.

415. Advanced Topics in the Theory of Groups. I; 1 unit. Prerequisite: Consent of instructor. Baer.

416. Advanced Topics in Abstract Algebra. I; 1 unit. Prerequisite: Consent of instructor. Baer.

419. Seminar in Algebra. I or II; 1 unit. Prerequisite: Consent of instructor.

420. Projective Geometry. I or II; 1 unit. Prerequisite: Mathematics 328.

421. Line Geometry. I or II; 1 unit. Prerequisite: Mathematics 328 and either Mathematics 420 or consent of instructor.

422. Algebraic Geometry. I; 1 unit. Prerequisite: Mathematics 328. Chanler.

423. Differential Geometry. I; 1 unit. Prerequisite: Mathematics 343. Levy.

424. Riemannian Geometry. I; 1 unit. Prerequisite: Mathematics 420, or 423, or consent of instructor. Levy.

425. Riemannian Geometry. II; 1 unit. Prerequisite: Mathematics 424. Levy.

426. Differential Geometry in the Large. I or II; 1 unit. Prerequisite: Mathematics 332, or 423, or consent of instructor.

427. Foundations of Geometry. I or II; 1 unit. Prerequisite: Mathematics 420.

428. Topics in Geometry. I or II; 1 unit. Prerequisite: Consent of instructor.

429. Seminar in Geometry. I or II; 1 unit. Prerequisite: Consent of instructor.

432. Separable Metric Spaces. I or II; 1 unit. Prerequisite: Mathematics 332.

433. Locally Connected Spaces. I; 1 unit. Prerequisite: Mathematics 332. Fort.

434. Combinatorial Theory of Polyhedra. I or II; 1 unit. Prerequisite: Mathematics 333.

435. Combinatorial Theory of Spaces. I or II; 1 unit. Prerequisite: Mathematics 332 and 434.

438. Topics in Topology. I, II; 1 unit. Prerequisite: Consent of instructor. Bourgin.

439. Seminar in Topology. I or II; 1 unit. Prerequisite: Consent of instructor.

440. Theory of Functions of a Complex Variable I. I or II; 1 unit. Prerequisite: Mathematics 348 and 349, or consent of instructor.

441. Functions of Real Variables. I, II; 1 unit. Prerequisite: Mathematics 347. Vaughan.

442. Measure and Integration. I, II; 1 unit. Prerequisite: Mathematics 347; consent of instructor. Munroe.

443. Ordinary Differential Equations. I; 1 unit. Prerequisite: One year of graduate analysis and consent of instructor. Trjitzinsky.

444. Partial Differential Equations. II; 1 unit. Prerequisite: Mathematics 443, or equivalent. Trjitzinsky.

445. Theory of Functions of a Complex Variable. I or II; 1 unit. Prerequisite: Mathematics 332 and 440, or consent of instructor. Ketchum.

446. Hilbert Space. I or II; 1 unit. Prerequisite: Mathematics 442.

447. Banach Spaces. I or II; 1 unit. Prerequisite: Mathematics 442. Day.

448. Locally Compact Groups and Their Representations. I; 1 unit. Prerequisite: Mathematics 442. Day.

449. Normed Rings. I; 1 unit. Prerequisite: Mathematics 318 and 446 or 447 or 448. Jerison.

450. Semi-Ordered Spaces. II; 1 unit. Prerequisite: Mathematics 446 or 447 or 448. Day.

451. Theory of Probability. I; 1 unit. Prerequisite: Mathematics 442. Doob.

452. Theory of Probability. II; 1 unit. Prerequisite: Mathematics 451. Doob.

453. Analytic Theory of Numbers. I; 1 unit. Prerequisite: Mathematics 348, 353, and 354.

454. Analytic Theory of Numbers. II; 1 unit. Prerequisite: Mathematics 453.

455. Mathematical Methods in Physics. I; 1 unit. Prerequisite: Mathematics 348. Ketchum.

456. Mathematical Methods in Physics. II; 1 unit. Prerequisite: Mathematics 455. Ketchum.

457. High-Speed Computing. II; 1 unit. Prerequisite: Mathematics 348. Taub.

458. Hydrodynamics. I or II; 1 unit. Prerequisite: Mathematics 348.

459. Topics in Hydrodynamics. I; 1 unit. Prerequisite: Consent of instructor. Taub.

460. General Relativity. Same as Physics 424. I; 1 unit. Prerequisite: Consent of instructor.

461. Special Relativity. II; 1 unit. Prerequisite: Consent of instructor.

462. Propagation. I or II; 1 unit. Prerequisite: Consent of instructor.

468. Topics in Analysis. I, II; 1 unit. Prerequisite: Consent of instructor.

469. Seminar in Analysis. I or II; 1 unit. Prerequisite: Consent of instructor.

470. Statistical Decision Functions. Statistics from the point of view of decision making; introduction to the theory of games; minimax and other decision functions; techniques for determining optional decision functions; applications to non-sequential and sequential decision making in practice. I; 1 unit. Prerequisite: Consent of instructor. Madow.

472. Econometrics. Same as Economics 472. Application of the principles of mathematical statistics to estimation of economic relationships. II; 1 unit. Prerequisite: Credit or registration in Mathematics 364. Hurwicz.

478. Topics in Statistics. I, II; 1 unit. Prerequisite: Consent of instructor. Madow.

481. Mathematical Logic. I; 1 unit. Prerequisite: Consent of instructor. Offered in 1950-1951 only. Davis.

482. Recursive Function Theory. II; 1 unit. Prerequisite: Consent of instructor. Offered in 1950-1951 only. Davis.

491. Research and Thesis. I; 1 to 4 units. Prerequisite: Consent of instructor. Staff.

492. Research and Thesis. II; 1 to 4 units. Prerequisite: Consent of instructor. Staff.

Courses for Graduates and Advanced Undergraduates

301. Fundamental Concepts of Mathematics. I; 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147. Chanler, Meserve.

302. Fundamental Concepts of Mathematics. II; 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147. Chanler, Meserve.

303. Foundations of Mathematics. I; 1 unit. Prerequisite: Consent of instructor. Vaughan.

304. Foundations of Mathematics. II; 1 unit. Prerequisite: Mathematics 303. Vaughan.

311. Advanced Algebra. For students interested in actuarial science, statistics, or teacher training in mathematics. I; 1 unit. Prerequisite: Mathematics 142, or consent of instructor. Ferguson, Miles.

312. Advanced Algebra. For students interested in actuarial science, statistics, or teacher training in mathematics. II; 1 unit. Prerequisite: Mathematics 142, or consent of instructor. Ferguson, Miles.

315. Linear Transformations and Matrices. I; 1 unit. Prerequisite: Mathematics 142. Hohn.

317. Introduction to Higher Algebra. I; 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147. Baer, Landin.

318. Introduction to Higher Algebra. II; 1 unit. Prerequisite: Mathematics 317. Baer, Landin.

327. Introduction to Higher Geometry. I; 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147.

328. Introduction to Higher Geometry. II; 1 unit. Prerequisite: Mathematics 327.

332. Topological Spaces. I or II; 1 unit. Prerequisite: Credit or registration in Mathematics 347. Fort.

333. Combinatorial Topology. I, II; 1 unit. Prerequisite: Mathematics 343. Cairns.

341. Differential Equations. I, II; 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147. Steimley.

342. Differential Equations. I, II; 1 unit. Prerequisite: Mathematics 341. Steimley.

343. Advanced Calculus. I, II; 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147.

345. Differential Equations and Orthogonal Functions. I, II; 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147.

347. Introduction to Higher Analysis: Real Variables. I, II; 1 unit. Prerequisite: Mathematics 343, or consent of instructor.

348. Introduction to Higher Analysis: Complex Variables. I, II; 1 unit. Prerequisite: Mathematics 347.

349. Introduction to Higher Analysis: Real Variables II. I or II; 1 unit. Prerequisite: Mathematics 347.

353. Elementary Theory of Numbers. I; 1 unit. Prerequisite: Mathematics 142.

354. Elementary Theory of Numbers. II; 1 unit. Prerequisite: Mathematics 353.

361. Theory of Probability. II; 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147. Munroe.

362. Finite Differences. I; 1 unit. Prerequisite: Mathematics 142. Peters.

363. Advanced Statistics. I; 1 unit. Prerequisite: Mathematics 132 and 142. Chernoff.

364. Advanced Statistics. II; 1 unit. Prerequisite: Mathematics 363. Chernoff.

366. Theory of Sample Surveys. Same as Communications 366. The development of the formulae to be used in the efficient planning of sample surveys and the interpretation of the results. I or II; 1 unit. Prerequisite: Calculus or Mathematics 112 and a first course in statistics. Madow.

367. Practice of Sample Surveys. Same as Communications 367. Training in planning and making sample surveys. How the results are interpreted. One or more sample surveys will be planned in detail. I or II; 1 unit. Prerequisite: Calculus or Mathematics 112 and a first course in statistics. Madow.

369. The Ideas and Methods of Statistics. The modern formulation of the ideas of statistical inference with applications to the testing of various statistical hypotheses. The treatment will stress, not the details, but the general nature of proofs. The interpretation of the ideas in practice will be given. I; 1 unit. Prerequisite: Mathematics 111 or 112 and a course in statistics. Madow.

370. The Ideas and Methods of Statistics. Continuation of Mathematics 369. II; 1 unit. Prerequisite: Mathematics 369. Madow.

371. Actuarial Theory. I; 1 unit. Prerequisite: Mathematics 132 and 142, or 137 and 147. Peters.

372. Actuarial Theory. II; 1 unit. Prerequisite: Mathematics 371. Peters.

373. Statistical Inference. Important techniques of constructing statistical tests. Applications in tests of goodness of fit, mean values, variance, and correlation. Discussion of problems and applications. I; 1 unit. Prerequisite: Mathematics 343. Madow.

374. Statistical Inference. Continuation of Mathematics 373. II; 1 unit. Prerequisite: Mathematics 373. Madow.

375. Nonparametric Inference. Nonparametric tests of hypotheses concerning means, variances, regression, and correlation of coefficients. Methods depending on ranks. The efficiency of nonparametric tests. I or II; 1 unit. Prerequisite: Mathematics 361 or 363. Blyth.

376. Parametric Inference. Introduction to the theories of estimation, testing hypotheses, and decision functions with respect to the parameters of distributions. The contributions of R. A. Fisher, J. Neyman, and A. Wald. The theory of the characteristic function will be introduced as needed. I or II; 1 unit. Prerequisite: Mathematics 361 or 363. Blyth.

377. Sequential Inference. An introduction to quality control, sampling inspection, and sequential analysis, with particular emphasis on the latter. Control charts; single, double, and multiple sampling inspection methods. Sequential probability ratio tests. Efficiency of sequential tests. Expected number of observations necessary. Operating characteristic and average sample number curves. I or II; 1 unit. Prerequisite: Mathematics 363. Chernoff.

381. Vector and Tensor Analysis. I; 1 unit. Prerequisite: Mathematics 343, or equivalent, or consent of instructor. Lass.

382. Vector, Tensor, and Matrix Methods in Applied Mathematics. II; 1 unit. Prerequisite: Mathematics 381, or consent of instructor. Bourgin, Lass.

386. Laplace Transforms. I; 1 unit. Prerequisite: Mathematics 343. Scott.

387. Introduction to Numerical Methods. I; 1 unit. Prerequisite: Mathematics 343.

388. Mathematical Methods in Engineering and Science. II; 1 unit. Prerequisite: Mathematics 343.

MECHANICAL ENGINEERING

The Department of Mechanical Engineering offers graduate work leading to the Master of Science and Doctor of Philosophy degrees. Advanced study and professional training are offered in the general fields of power, design, and production.

The prerequisite for graduate work in mechanical engineering is the equivalent of the undergraduate course requirements for the degree of Bachelor of Science in mechanical engineering at the University of Illinois, together with a grade-point average of at least 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students on limited status will not be admitted to this Department. Students who have obtained graduate credit in some other university may apply for admission provided, (1) their undergraduate records meet the above requirements, and (2) their grade-point averages in graduate work are at least 4.0.

All students who receive permits to enter the Graduate College in mechanical engineering, regardless of whether they have had training beyond the bachelor's degree, must take orientation examinations. These are offered in September and February during the week prior to the opening of the regular semester sessions. Students who are admitted to a summer session must take this examination in September if they plan to continue. Those who intend to major in any field of mechanical engineering must take four examinations covering undergraduate instruction in design, power, production, and basic science (including physics, chemistry, and mathematics). The results of these orientation examinations are not permanently recorded, but serve merely to assist in the registration of students in the proper graduate courses. Students who demonstrate through these examinations that they are deficient will be required to register in one or more specific courses before taking more advanced work in a particular field. Students who have received permission to enter the Graduate College in mechanical engineering

should write the Department immediately to learn the dates when these orientation examinations will be given and to obtain any other detailed information necessary.

Courses numbered in the 300 group are those open to advanced undergraduate and graduate students, and those in the 400 group are for graduate students only. In registering for a course with variable credit, as one-half to one and one-half units, each student puts on his program card the number of units for which he intends to take the course. Courses numbered in the 300 group have variable credits of one-half to three-fourths unit; the one-half unit represents credit for work corresponding to advanced undergraduate study, the additional one-fourth unit requires a term paper.

Except under unusual circumstances the maximum number of credits which will be permitted in any course ending in 8 or 9 will be three units towards the requirements for a master's degree. An additional four units of credit will be permitted for candidates working towards a doctor's degree. In most cases the research work conducted in these laboratory investigations can be reported in the thesis submitted for fulfillment of the requirements for each degree. A minimum of eight units must be completed for the master's degree when a thesis is included. The requirement of a master's thesis may be waived in exceptional cases, but a minimum of nine units is required if a thesis is not included.

For further information see the booklet "Graduate Study and Research in Mechanical Engineering." Copies may be obtained from the Department of Mechanical Engineering, Mechanical Engineering Building, Urbana, Illinois.

Fellowships and Assistantships

The Eastman Kodak Company of Rochester, New York, has made available a graduate fellowship of $750 to a worthy and needy engineer who has established a high scholastic record in his undergraduate work and who is interested in advanced work in machine design. The recipient of this fellowship must be a graduate of some engineering school other than the University of Illinois.

A limited number of part-time teaching assistantships are available to students of superior attainment with either a Bachelor of Science or Master of Science degree in mechanical engineering. The stipend is $1,200 for a half-time assistant and $600 for a quarter-time assistant, for a school year of two semesters, and exemption from tuition, laboratory, library, and supply fees. A half-time assistant can carry up to three units of graduate work each semester. Application forms may be obtained from the Head of the Department of Mechanical Engineering.

A limited number of half-time research graduate assistantships are offered by the Engineering Experiment Station. The recipients of these assistantships agree to hold them for two school years. The stipends and other terms are the same as those for teaching assistant. Application forms may be obtained from the Dean of the College of Engineering, Civil Engineering Hall, Urbana, Illinois.

Graduate Teaching Faculty

Professors: N. A. Parker (Head of Department), W. N. Espy, J. R. Fellows, W. L. Hull, S. Konzo, E. Laitala, R. F. Larson, J. H. Potter, D. G. Ryan, H. J. Schrader, W. H. Severns, K. J. Trigger.

Associate Professors: E. L. Broghamer, G. W. Harper, J. A. Henry, H. H. Korst, D. H. Krans, R. J. Martin, L. C. Pigage, F. Seyfarth.

Assistant Professor: L. M. Zubko.

Research Assistant: B. T. Chao.

Courses for Graduates

401. Thermodynamics. Application of thermodynamics to the analysis and solution of engineering problems involving energy transfer and conversion. I; 1 unit. Prerequisite: One year course in thermodynamics. Espy.

402. Thermodynamics of Gaseous Equilibrium. Application of thermodynamics to analysis of combustion of gases used as working media in power production. II; 1 unit. Prerequisite: One year course in thermodynamics. Espy.

403. Advanced Combustion. A study of the theories of combustion. Solid, liquid, and gaseous fuels as used in engineering structures. Emphasis on experimental methods in combustion. I; 1 unit. Prerequisite: Undergraduate courses in thermodynamics and differential equations. Potter.

404. Gas Dynamics. Properties of compressible fluids, subsonic and supersonic flow, steady and non-steady motion, one-, two-, and three-dimensional problems, shock waves, special problems in connection with combustion engines. I; 1 unit. Prerequisite: Differential equations, thermodynamics, and fluid mechanics. Korst.

405. Heat Transfer. Analysis of the methods and mechanisms of heat transfer: dimensional analysis method, design of heat exchangers, transient state heat transfer. Special problems in insulation and heat transfer. I; 1 unit. Prerequisite: Undergraduate course in heat transfer. Larson.

406. Heat Conduction in Solids. Fundamentals; general differential equation of heat conduction; methods of solution; steady state heat flow; transient heat flow, one and two dimensions; periodic flow of heat; internal heat source in solids. I; 1 unit. Prerequisite: Undergraduate courses in heat transfer and differential equations. Chao.

408. Laboratory Investigations in Thermodynamics. Special investigations involving thermodynamic analysis, thermodynamic properties, and performance of physical and chemical systems. I, II; ½ to 1½ units. Prerequisite: One year course in thermodynamics and one-half year course in power laboratory. Espy, Korst.

409. Laboratory Investigations in Fluid Flow, Heat Transfer, and Combustion. Special investigations in flow, metering, heat transfer, heat exchanger performance and design. I, II; ½ to 1½ units. Prerequisite: Courses in thermodynamics and fluid mechanics. Korst, Krans, Larson, Potter.

413. Industrial Control Systems. Study of basic elements of process control systems and process characteristics, particularly of thermal and mechanical processes. II; 1 unit. Prerequisite: Mechanical Engineering 311, or equivalent.

421. Heating and Air Conditioning. Advanced study of heating, ventilating, and air conditioning. Factors affecting heat loss and heat gain of building, physiological effects of environment, equipment design of heat transfer equipment. Individual problems. I; 1 unit. Prerequisite: Undergraduate course in heating, ventilating, and air conditioning. Fellows, Konzo.

422. Heating and Air Conditioning Design. Factors affecting design of steam, hot water, and air systems, including pipe and duct design, heat transfer rates, and control of equipment. Special topics such as panel heating, electrical heating, radiant heating, reverse cycle refrigeration. II; 1 unit. Prerequisite: Undergraduate course in heating, ventilating, and air conditioning. Fellows, Konzo.

423. Refrigeration Theory and Application. Advanced study of processes and cycles; design problem; and special applications. II; 1 unit. Prerequisite: Undergraduate course in refrigeration. Martin.

428. Laboratory Investigations in Refrigeration. Special investigations in refrigeration. I, II; ½ to 1½ units. Martin and others.

429. Laboratory Investigation in Heating and Air Conditioning. Special investigations in heating, ventilating, and air conditioning. I, II; ½ to 1½ units. Prerequisite: Two semesters of power laboratory, or equivalent. Fellows, Konzo, and others.

431. Gas Turbines and Reaction Machines. Analysis of gas turbine cycles, media, combustion, construction and operation, impulse and reaction machinery; heat exchange and insulation. II; 1 unit. Prerequisite: Undergraduate courses in thermodynamics, fluid mechanics, power equipment, and power laboratory. Larson.

432. Theory of Rotary Compressors. Thermodynamical and mechanical fundamentals, compression with and without cooling, classification of compressors, similarity considerations and characteristics, principles of and computations for radial compressors, improvement in performance of integrating parts; axial flow compressors; lattice and airfoil theory; change in operating conditions of turbocompressors; regulation; rotary positive blowers. II; 1 unit. Prerequisite: Undergraduate courses in thermodynamics and fluid mechanics (Mechanical Engineering 205 and 206; Theoretical and Applied Mechanics 232 or Aeronautical Engineering 211 and 212). Korst.

433. Prime Movers. Steam and diesel engines, and steam, gas and hydraulic turbines as power prime movers. Detailed analysis of flow and internal losses in steam and hydraulic turbines. II; 1 unit. Prerequisite: Undergraduate courses in power plant equipment and thermodynamics. Potter.

438. Laboratory Investigations in Power Machinery. Special investigations in power machinery, such as turbines, engines, fans, and compressors. I, II; ½ to 1½ units. Prerequisite: One year course in power laboratory. Hull, Krans, Potter, and others.

441. Machine Design. A technical application course designed to focus the previously acquired design experience on the creative problem of developing machines to perform specified functions; proper consideration of manufacturing processes involved; checking of all parts for stress, wear, vibration, fatigue, etc. I; 1 unit. Prerequisite: Undergraduate course in dynamics of machines and one year of machine design. Ryan.

442. Product Design. A detailed analysis of the various constituent mechanisms and apparatus in power-driven machines designed for, or adapted to, special industrial operations such as those found in mass production. This analysis includes not only the machine itself and its mechanisms and auxiliary apparatus and attachments, but also such items as tools, jigs, fixtures, etc. The material and final product studied with reference to the design or modification of new machines or apparatus, or the adaptability of existing machines or apparatus, to its production. II; 1 unit. Prerequisite: Undergraduate course in dynamics of machines and one year of machine design. Ryan and others.

443. Dynamics of Machinery. A course complementary to the undergraduate course and devoted to a more detailed study of velocities, accelerations, and forces in machine parts having reciprocating, rotating, and combined motions; balancing, critical speeds, and vibrations in shafts; gyroscopic

action in machines; flywheels, governors, and special topics. I; 1 unit. Prerequisite: Undergraduate course in dynamics of machines and one year of machine design.

444. Analytical Design of High-Speed Engines. A study of the dynamics of high-speed engines with special reference to internal combusion engines, engine balance, crankshaft deflections, torsional vibrations. II; 1 unit. Prerequisite: Undergraduate course in dynamics of machines and one year of machine design. Broghamer.

445. Design of Internal Combustion Engines. Detailed study of the design of the internal combustion engine; gas-pressure and inertia-force diagrams; determination of bearing loads; torsional vibration analysis; stress determinations and design of important parts, including piston, connecting rod, crankshaft, flywheel, valve mechanism, and cam layout. I; 1 unit. Prerequisite: Undergraduate course in dynamics of machines, one year of machine design, and undergraduate course in internal combustion engines. Hull.

446. Power Plant Design. A design course covering the selection of equipment, and problems involved in the design and layout of a modern plant. II; 1 unit. Prerequisite: Undergraduate courses in machine design and power. Seyfarth.

448. Laboratory Investigations in Machine Design. Special investigations in machine design. I, II; ½ to 1½ units. Broghamer, Ryan.

451. Materials Processing. A study of the theoretical factors involved in metal cutting and forming. Basic mechanics of machining processes, friction and surface finish. Temperatures developed during machining operations and the effect upon chip formation. Analysis of experimental data. Lecture and discussion periods. Survey of current literature and special topic assignments. I; 1 unit. Prerequisite: Undergraduate courses in advanced metal processing and heat treatment of metals or physical metallurgy. Trigger.

453. Methods and Measurements of Industrial Work. Advanced theoretical analysis of factors affecting determination of economical methods, method standards, and time standards for industrial operations. Special investigations and term paper. I; 1 unit. Prerequisite: Undergraduate course in motion and time study, and production control. Laitala.

454. Production Engineering. Advanced consideration of production engineering principles as related to cost analysis and reduction, control of flow of work in manufacture, evaluation of performance against standard, and compensation. Special investigations. II; 1 unit. Prerequisite: Mechanical Engineering 453. Laitala, Pigage.

456. Measurement Standards. Precision measurements in the field of production engineering, including interference phenomena of light, dimensional measurements, physical standards of reference, gages, surface measurements, and theory of the profilometer. I; ½ unit. Prerequisite: Undergraduate courses in tool engineering and advanced metal processing, or equivalent.

458. Laboratory Investigations in Production. Special investigations in the field of production, particularly in materials processing, metal cutting, and production engineering. I, II; ½ to 1½ units. Laitala, Pigage, Trigger.

468. Laboratory Investigations in Railway Mechanical Engineering. Special investigations in the field of railway mechanical engineering. I, II; ½ to 1½ units. Prerequisite: Bachelor of Science degree in mechanical engineering. Schrader.

478. Laboratory Investigation in Petroleum Production Engineering. Special investigations in field of petroleum production engineering. I, II; ½ to 1½ units. Prerequisite: Bachelor of Science degree in mechanical engineering; Mechanical Engineering 371, or equivalent. Larson.

491. Thesis (M.S. or Ph.D.). I; 1 to 2 units. Staff.

492. Thesis (M.S. or Ph.D.). II; 1 to 2 units. Staff.

493. Seminar. Presentation and discussion of significant developments in mechanical engineering. I, II; no credit. Konzo.

Courses for Graduates and Advanced Undergraduates

301. Engineering Thermodynamics. Application of thermodynamics to engineering processes with special attention to steady flow of a compressible medium in insulated or non-insulated ducts, availability of thermal energy, heat and power from combustion, methods of formulation and correlation of properties of a pure substance, and effect of equilibrium on the analyses of internal combustion engines and cycles. I, II; ½ to ¾ unit. Prerequisite: Mechanical Engineering 205 and 206; consent of instructor. Espy.

303. Fuels and Combustion. Fuel resources; composition and specification of natural and manufactured fuels; combustion stoichiometry, fuel calorimeters; coal, oil, and gas burners; fire box and chimney design; smoke abatement. I; ½ to ¾ unit. Prerequisite: Chemistry 101 and 104, or equivalent; Mechanical Engineering 207, or equivalent. Fellows.

305. Thermodynamics of High-Velocity Flow. The thermodynamics of gases during high-velocity flow within enclosed channels using Mach number as the fundamental variable; analyses of the basic flow equations, effects of friction and plane shock theory; application to thermodynamic cycles involving nozzles, diffusers, compressors, combustion, and turbines. I, II; ½ to ¾ unit. Prerequisite: Mechanical Engineering 206, or consent of instructor. Zubko.

311. Instrumentation and Measurements. Instruments and measuring equipment for flow, temperature, pressure, speed, and gas analysis. I, II; ½ to ¾ unit. Konzo.

314. Lubrication. The theories of lubrication; manufacture and properties of lubricants; methods of testing; lubrication methods and appliances. A study of the lubrication requirements of machines of many kinds. I; ½ to ¾ unit. Prerequisite: Undergraduate courses in machine design and fluid mechanics.

332. Theory of Internal Combustion Engines. Study of thermodynamics of reciprocating engine cycles, considering such factors as chemical dissociation, heat loss, combustion chamber shape, and flow through valves and manifolds. II; ½ to ¾ unit. Prerequisite: Undergraduate course in internal combustion engines. Hull.

357. Problems in Industrial Safety. Fundamentals covered in Mechanical Engineering 235, Industrial Safety, will be expanded, with special emphasis on problems in design, production layout, codes, guarding, chemical and electrical hazards, and industrial hygiene. II; ½ to ¾ unit. Prerequisite: Mechanical Engineering 235; consent of instructor. Harper.

361. Railway Motive Power Equipment. A technical study of the various types of motive power used on railways with special emphasis on steam, Diesel, and electric locomotives, and secondary consideration to special types such as the steam turbine, turbo-electric and gas turbine locomotives. I; ½ to ¾ unit. Schrader.

362. Railway Motive Power Operation. A study of the conditions under which railway motive power operates; economics of operation, present equipment, proposed new equipment, servicing, and maintenance; availability; train resistance, motive power tractive force, speed time and distance curves, preparation of time tables; problems in stopping trains; terminal and repair facilities. II; ½ to ¾ unit. Schrader.

371. Petroleum Production Engineering — Field Development. Properties of petroleum, oil reservoirs, exploration and drilling methods, casing methods, and well logging. I; ½ to ¾ unit. Prerequisite: Consent of instructor. Larson.

372. Petroleum Production Engineering. Study of reservoir performance, principle of oil and gas recovery, storage and transportation, and economics of oil field exploitation. II; ½ to ¾ unit. Prerequisite: Mechanical Engineering 371. Larson.

MINING AND METALLURGICAL ENGINEERING

The Department of Mining and Metallurgical Engineering offers graduate work leading to the Master of Science and Doctor of Philosophy degrees. The prerequisite for graduate work with metallurgical engineering or mining engineering as a major is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in the major field of study at the University of Illinois. A student who is deficient in background and previous training may be required to register in certain undergraduate courses (without graduate credit) as a prerequisite to graduate work. At the end of the student's first registration his adviser will enter on a "Memorandum of Prerequisites" the undergraduate courses necessary for the student to complete. The departmental scholastic requirements for admission to graduate study on full status, advanced status, and limited status are given on page 12.

A candidate for the degree of Master of Science is ordinarily required to have a minimum of eight units of graduate work, including a thesis. However, a degree will not be granted for this minimum if a student receives one unit of "C" unless he also receives one unit of "A", or to one who receives more than one unit of "C." Additional work will be required of a student who does not meet this standard.

If a petition to waive the thesis requirement is granted, a minimum of nine units of graduate work will be required.

The thesis requirement will not be waived for research graduate assistants or, in general, for assistants on research projects. For research graduate assistants and others on a half-time status, a minimum length of residence of three semesters will be required for a master's degree, regardless of the number of units of credit obtained.

In addition to the general requirements of the Graduate College for the degree of Doctor of Philosophy in Engineering, certain departmental requirements also are applicable. The languages ordinarily required of a candidate in metallurgical or mining engineering are French and German. With the approval of the department, a student may petition to the Executive Faculty requesting permission to substitute Russian for the French language examination if it can be shown that in the student's special field of research the literature available in the substituted language is more significant.

Announcement of the thesis subject, with approval of the adviser, must be made at or before the beginning of the third year of study. A prerequisite to the preliminary examination is the choice by the student of an acceptable subject for his thesis.

Before a candidate is admitted to the oral preliminary examination, he is required to pass a series of written preliminary examinations. The written examinations are given several weeks in advance of the oral preliminary examination. The written examinations are intended to discover the candidate's competence in and knowledge of his field. The examinations need not be based only on formal course work, but are intended to determine the student's knowledge of his entire field including his knowledge of previous work, history, and practice in his field of specialization.

A candidate for the degree of Doctor of Philosophy is required to pursue a major in the subject in which his research lies. He is also required to choose one minor subject, or he may choose two minor subjects. If one minor only is chosen it must be taken in a department of study other than that of the major, and credit for it may be earned by work representing not less than four units (a total of twenty-four units of graduate work is required for the doctorate). If two minors are chosen, one must be closely related to the major, and the second minor (not less than two units) must be taken in a department of study other than that of the major, or first minor. Acceptable minors, unless special permission is granted by petition, will be from the following subjects: physical chemistry, analytical chemistry, geology, mathematics, theoretical and applied mechanics, and physics.

The department publishes a brochure, entitled "Graduate Study and Research in Mining and Metallurgical Engineering," which gives further details about departmental requirements for graduate study. Copies may be secured by addressing the Head of the Department of Mining and Metallurgical Engineering.

Fellowships and Assistantships

A number of graduate fellowships in mining engineering have been established by the Sahara Coal Company. One or more are awarded each year on recommendation of the Department of Mining and Metallurgical Engineering. They are for one to three years of graduate study and research in coal-mining engineering. The stipend is $700 for first year, $850 for second year, and $1,000 for third year fellowships.

One fellowship is offered annually by Olin Industries, Inc., to a second or third-year graduate student in metallurgical engineering for research in titanium and its alloys. It is awarded with a stipend of $850 for second year and $1,000 for third year of study, on recommendation of the head of the Department of Mining and Metallurgical Engineering.

A number of research assistantships on one-half time or one-quarter time basis are available to graduate students in mining or metallurgical engineering. The stipend is $1,200 for a half-time assistant and $600 for a quarter-time assistant, for a school year of two semesters, and exemption from tuition, laboratory, library, and supply fees. A half-time assistant may carry up to three units of graduate work each semester. It is usually possible to assign an assistant to duties in the field of his special interest. Inquiries concerning these positions should be directed to the Head of the Department of Mining and Metallurgical Engineering.

Graduate Teaching Faculty

Professors: H. L. Walker (Head of Department), W. R. Chedsey, W. H. Voskuil.

Associate Professors: W. H. Bruckner, E. J. Eckel, A. C. Forsyth, B. G. Ricketts, C. A. Wert.

Assistant Professors: G. B. Clark, H. Czyzewski, V. D. Hildebrandt, J. W. Marx.

MINING ENGINEERING

Courses for Graduates

401. Advanced Mineral Dressing and Coal Preparation. Advanced theory and practice of mineral dressing and coal preparation processes. I or II; 1 unit. Chedsey.

402. Mine Valuation, Taxation, and Mineral Economics. A study of current methods of evaluating mine properties; methods of taxation of mine properties and mineral reserves; and the relation of mineral resources to economics of society. I or II; 1 unit. Chedsey.

403. Advanced Mine Administration. Current methods and systems of mine administration in use by major mining corporations. I or II; 1 unit. Chedsey.

491. Research in Mining Engineering and Mineral Dressing. Individual research in some phase of the general field of mining engineering and under the supervision of a member of the staff. Results of research may be used for graduate thesis. I, II; ½ to 4 units. Chedsey.

492. Research in Mining Engineering and Mineral Dressing. Individual research in some phase of the general field of mining engineering and under the supervision of a member of the staff. Results of research may be used for graduate thesis. I, II; ½ to 4 units. Chedsey.

Courses for Graduates and Advanced Undergraduates

302. World Mineral Economics. The role of minerals in a productive economy; the interdependence of minerals in industrial society and the problems arising out of their unequal geographic distribution and divided political control. II; ¾ to 1 unit. Voskuil.

351. Geophysics of Mining. Same as Geology 351. Principles of geophysics and their application to mining processes. I; 1 unit. Prerequisite: Consent of instructor. Chedsey.

396. Seminar. Review of mining literature; reports; technical writing. II; ¼ unit. Chedsey.

METALLURGICAL ENGINEERING

Courses for Graduates

401. Advanced Physical Metallurgy. Fundamentals of ternary systems, ferrous metallurgical design, and gases in metals. I or II; 1 unit. Prerequisite: Equivalent of the undergraduate courses required in metallurgical engineering. Eckel.

402. Advanced Metallographic Technique. Advanced study of metallographic laboratory procedure. II; 1 unit. Ricketts.

403. Tool Steels and Related Alloys. The course includes the metallurgical considerations related to the melting, casting, working, heat treatment, and inspection of the various classes and types of tool, die, and related complex alloy steels. I; 1 unit. Forsyth.

404. Stainless Steels and High Temperature Alloys. Classification of stainless steels into three major classes: martensitic, ferritic, and austenitic. A

detailed study is made of each class. The high temperature alloys are conveniently studied in four groups, namely, iron base, nickel base, cobalt base, and miscellaneous in which molybdenum plays an important role. II; 1 unit. WALKER.

491. RESEARCH. Individual research in specialized problems and under supervision of members of staff. Results of research may be used for graduate thesis. I, II; ½ to 4 units. STAFF.

492. RESEARCH. Individual research in specialized problems and under supervision of members of staff. Results of research may be used for graduate thesis. I, II; ½ to 4 units. STAFF.

498. SEMINAR. Review of current research literature and departmental research program. Graduate students will present thesis research. Required of all graduate students in metallurgical engineering. I; no credit.

499. SEMINAR. Review of current research literature and departmental research program. Graduate students will present thesis research. Required of all graduate students in metallurgical engineering. II; no credit.

Courses for Graduates and Advanced Undergraduates

301. METALLURGY OF WELDING. A survey is made of existing welding procedures and their metallurgical (ferrous and non-ferrous) consequences with respect to the weld and base metal involved thermally in the welding operations. Heat flow in metals, arc behavior, slag behavior, and the physical metallurgy of heat-affected base metal are considered. Engineering phases of welding covered are economics of welding in relation to other methods of joining metals or producing engineering structures, thermal stresses, specification of materials for weld and base metal, and methods of production by means of welding and gas cutting. I or II; ¾ or 1 unit. Prerequisite: Metallurgical Engineering 208 and 210. BRUCKNER.

302. POWDER METALLURGY. Production of powder metals; fabrication of metal shapes from powder metals; compacting, sintering, testing, and application of powdered metal shapes. II; ¾ or 1 unit. Prerequisite: Approval of department; registration in Metallurgical Engineering 304. ECKEL.

304. POWDER METALLURGY LABORATORY. Experiments involving the testing, briquetting, sintering, repressing of metal powders, and the testing of sintered compacts. II; ¼ unit. Prerequisite: Approval of department; registration in Metallurgical Engineering 302. ECKEL.

305. METALLURGY OF STEEL CASTING. Technical and metallurgical control in the production of steel castings; acid and basic furnace practices; control of slag in steel making; heat treatment and metallography of steel castings. I, II; ¾ or 1 unit. Prerequisite: Metallurgical Engineering 205, 208, and 210. CZYZEWSKI.

306. PHYSICS OF METALS. The physical form of alloys; elastic and plastic behavior; creep, internal friction; failure phenomena; diffusion; modern metal physics concepts; electron theory of metals. I or II; ¾ or 1 unit. CZYZEWSKI.

308. METALLURGICAL KINETICS AND THERMODYNAMICS. Fundamental thermodynamic considerations and application of thermodynamics to metallurgical problems. II; ¾ unit. Prerequisite: Chemistry 246. Offered in 1951-1952 and in alternate years. HILDEBRANDT.

A Part of the University Symphony Orchestra at Rehearsal

MUSIC

The School of Music offers degrees of Master of Music and of Master of Science in Music Education. For the degree of Master of Music, the major field may be in musicology, music theory and composition, music literature, applied music (organ, voice, piano, violin, cello), or band and orchestra conducting.

The admission requirement, in terms of grade-point average, is at least 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students will be admitted on limited status.

In addition, an applicant for admission to graduate study in music is required: (1) to have finished successfully a four-year undergraduate curriculum in music or music education, or their equivalent in hours and content, from an institution which holds membership in, or is listed by, the Association of American Universities, or from a liberal arts college recognized by the North Central Association or equivalent regional accrediting association; (2) to pass a qualifying examination in the major field or concentration to be administered by the Graduate Committee of the School of Music. If the major is to be applied music, music literature, music education, or band and orchestra conducting, this examination is essentially one of performance on the major instrument and is given at specified times during the year. If an applicant is unable to appear before the Graduate Committee, recordings may be substituted. If the major is to be musicology, theory, or composition, applicants must present evidence to the committee of their ability to pursue work on the graduate level. For the field of musicology, a reading knowledge of both German and French is desirable. Each applicant will furnish the Graduate Committee of the School of Music a copy of his official undergraduate transcript. Inquiries concerning graduate work in Music should be addressed to Duane A. Branigan, Acting Director.

Candidates for the degree of Master of Science in Music Education must earn four units in music, three of which are electives, two units in education, and two units in electives. Requirements are Music 427, one unit; music electives, three units; two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit. The electives must be selected with the approval of the adviser. Three electives must be in music, and the other two in music, in education, or, in exceptional cases, in other fields. The grade-point average required for admission is the same as required by the Department. Limited status students will not be admitted to this program. The advisers for candidates for this degree are Professor Duane A. Branigan, 100 Smith Music Hall, and Professor Velma K. Wilson, 200a Smith Music Hall.

Graduate Teaching Faculty

Professors: D. A. Branigan (Acting Director of the School of Music), S. Fletcher, B. R. Foote, W. G. Hill, H. Kessler, J. M. Kuypers, R. H. Miles, S. Schoonmaker, P. Young.

Associate Professors: Dorothy E. Bowen, B. M. Goodman, L. R. Hamp, M. H. Hindsley, K. Kellogg, P. Painter, B. Phillips, L. A. Potter, P. Rolland, W. L. Roosa, H. C. Schmitt, S. Stravinsky, R. H. Swenson, Edith Usry, G. R. Waller, Jane C. Watt, E. H. Weigel, Velma K. Wilson.

Assistant Professors: J. Allen, G. W. Binkerd, Beth Bradley, J. R. Kelly, E. D. Kisinger, W. Miller, P. S. Pettinga, Claire L. Richards, H. O. Sexton, Miriam B. Stewart, L. E. Zirner.

Instructors: A. M. Carter, Dorothy E. Clark, Phyllis Edwards, J. C. Garvey, M. C. Howe, Mary F. James, D. A. Ledet, A. J. McDowell, P. W. Price, E. V. Putnik, L. A. Starr.

Courses for Graduates

406. Advanced Theory and Composition. Advanced study of contrapuntal forms; study of contemporary melodic and harmonic practices; original work in advanced composition. I, II; ½ to 1½ units. Kessler, Phillips.

410. Advanced Instrumentation. Orchestrate for chamber and symphony orchestras, works of classical, romantic, and modern composers. I; ½ to 1 unit. Prerequisite: Undergraduate instrumentation. Kelly.

411. Advanced Instrumentation. Arrange for the concert band works from orchestra, organ, and chamber music by composers of the classical, romantic, and modern periods. II; ½ to 1 unit. Prerequisite: Undergraduate instrumentation. Hindsley.

414. Advanced Instrumental Conducting, Administration, and Literature. I; 1 to 1½ units. Prerequisite: Bachelor's degree with major work or experience in band and/or orchestra; consent of instructor. Hindsley.

415. Advanced Instrumental Conducting, Administration, and Literature. II; 1 to 1½ units. Prerequisite: Bachelor's degree with major work or experience in band and/or orchestra; consent of instructor.

416. Advanced Choral Conducting, Literature, and Administration. Deals with the training and conducting of choral groups, including musical and organizational problems. I or II; 1 unit. Young.

427. Administration and Supervision of Music Education. II; 1 unit. Prerequisite: Bachelor of Science degree in music education or in education with a music major, or Bachelor of Music degree, including music education courses. V. Wilson.

430. Instrumental Music of the Eighteenth Century. I; 1 unit. Offered in 1951-1952 and in alternate years. Hill.

431. The Sonata. II; 1 unit. Offered in 1951-1952 and in alternate years. Hill.

432. Beethoven. I; 1 unit. Offered in 1950-1951 and in alternate years. Hill.

433. Beethoven. II; 1 unit. Offered in 1950-1951 and in alternate years. Hill.

436. Johann Sebastian Bach. The life and times of Johann Sebastian Bach, with a critical and analytical study of selected groups of representative works from all fields of his creative activity. I; 1 unit. Prerequisite: Representative theory and history courses required for the Bachelor of Music degree. Miles.

437. Johann Sebastian Bach. The life and times of Johann Sebastian Bach, with a critical and analytical study of selected groups of representative works from all fields of his creative activity. II; 1 unit. Prerequisite: Representative theory and history courses required for the Bachelor of Music degree. Miles.

460. Graduate Applied Music (Piano). I, II; 1½ units. Prerequisite: Bachelor of Music degree and successful completion of a qualifying examination given by the graduate committee. Applied Music Faculty.

461. Graduate Applied Music (Voice). I, II; 1½ units. Prerequisite: Bachelor of Music degree and successful completion of a qualifying examination given by the graduate committee. Applied Music Faculty.

462. Graduate Applied Music (Organ). Selected studies from the masterworks of organ literature. I, II; 1½ units. Prerequisite: Bachelor of Music degree and successful completion of a qualifying examination given by the graduate committee. Applied Music Faculty.

463. Graduate Applied Music (Violin). I, II; 1½ units. Prerequisite: Bachelor of Music degree and successful completion of a qualifying examination given by the graduate committee. Applied Music Faculty.

464. Graduate Applied Music (Cello). I, II; 1½ units. Prerequisite: Bachelor of Music degree and successful completion of a qualifying examination given by the graduate committee. Applied Music Faculty.

480. Piano Literature. I; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education degree, and qualifying examination given by the graduate committee. Kessler.

481. Piano Literature. II; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education degree, and qualifying examination given by the graduate committee. Kessler.

482. Vocal Literature. Study of solo song in larger works. I; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education degree, and qualifying examination given by the graduate committee. Kellogg.

483. Vocal Literature. Study of solo art song. II; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education degree, and qualifying examination given by the graduate committee. Kellogg.

484. Organ Literature. An intensive study of organ literature to the time of Bach. The material includes the music itself, recordings, and collateral readings. I; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education degree, and qualifying examination given by the graduate committee. Miles.

485. Organ Literature. An intensive study of organ literature from Bach to the present. The material includes the music itself, recordings, and collateral readings. II; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education degree, and qualifying examination given by the graduate committee. Miles.

486. String Instruments Literature. I; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education degree, and qualifying examination given by the graduate committee. Roosa.

487. String Instruments Literature. II; 1 to 1½ units. Prerequisite: Bachelor of Music or Bachelor of Science in Music Education degree, and qualifying examination given by the graduate committee. Roosa.

491. Research in Special Fields. Research in particular subjects in the fields of music history and theory. I; 1 unit. Branigan, Hill, Hindsley, Kellogg, Kessler, Kuypers, Miles, V. Wilson.

492. Research in Special Fields. Research in particular subjects in the fields of music history and theory. II; 1 unit. Branigan, Hill, Hindsley, Kellogg, Kessler, Kuypers, Miles, V. Wilson.

Courses for Graduates and Advanced Undergraduates

300. Theory of Music — Advanced Harmony. Advanced harmony; altered chords; notation and harmonization of the chromatic scale; chromatic modulation; enharmonic transformations; use of inharmonic tones; harmonic analysis. I; ¼ unit. Prerequisite: Music 107. Binkerd, Phillips.

301. Theory of Music — Advanced Harmony. Advanced harmony: altered chords; notation and harmonization of the chromatic scale; chromatic modulation; enharmonic transformations; use of inharmonic tones; harmonic analysis. I, II; ¼ unit. Prerequisite: Music 300. Binkerd, Phillips.

302. Theory of Music — Free Counterpoint. Creative writing in linear counterpoint of the following: rounds, instrumental and vocal; canons; inventions; and fugues. Analysis of Bach inventions and well-tempered clavichord. I; ½ unit. Prerequisite: Music 301. Kelly.

303. Theory of Music — Free Counterpoint. Creative writing in linear counterpoint of the following: rounds, instrumental and vocal; canons; inventions; and fugues. Analysis of Bach inventions and well-tempered clavichord. II; ½ unit. Prerequisite: Music 302. Kelly.

306. Composition. Work in original composition including the study of fugue, canon, and of the small and large homophonic forms. I, II; ½ to 1 unit. One unit of credit given when the course is taken as major subject involving the preparation of a recital program of original compositions. Prerequisite: Music 107, or consent of instructor. Theory and Composition Faculty.

314. Analysis of Musical Form. An elementary, systematic survey of the principles and means employed in musical composition. I; ¼ unit. Prerequisite: Music 107. Hill.

315. Analysis of Musical Form. A continuation of Music 314. II; ¼ unit. Prerequisite: Music 314. Hill.

316. Teaching of Theory and Harmony. Techniques and materials used in the teaching of theory of music in senior high school and junior college. I, II; ½ unit. Prerequisite: Music 300, or consent of instructor. Carter.

320. Advanced History of Music. I; ½ unit. Prerequisite: Music 226 and 227. Hill.

321. Advanced History of Music. II; ¼ unit. Prerequisite: Music 320. Hill.

324. The Music Dramas of Richard Wagner. Trends in opera at the time of Richard Wagner. His influence on opera composition and development of his own style. I; ½ unit. Prerequisite: Music 110 and 114, or 117, or consent of instructor.

325. The Music Dramas of Richard Wagner. Trends in opera at the time of Richard Wagner. His influence on opera composition and development of his own style. II; ½ unit. Prerequisite: Music 110 and 114, or 117, or consent of instructor.

327. Contemporary Music. A survey of all important trends, forms, and styles of modern music from 1875 to the present. I, II; ½ unit. Prerequisite: Consent of instructor.

330. Instrumental Clinic. Application of principles and techniques taught in previous music education courses. I; ½ unit. Prerequisite: Music 217, 220, 221, or consent of instructor. Starr.

331. Instrumental Clinic. Application of principles and techniques taught in previous music education courses. II; ½ unit. Prerequisite: Music 217, 220, 221, or consent of instructor. Starr.

334. Methods of String Class Teaching. Designed primarily for teachers of school music who may or may not be performers on a stringed instrument but who wish to teach classes and start an orchestral program in the schools. S; ½ unit. Prerequisite: Consent of instructor. Waller.

338. Music Bibliography and Reference. Detailed study of basic and most useful reference and bibliographic aids; practice problems in use of specific titles; how to find materials in library; music, books about music, and recordings of music are included. I, II; ½ unit. Prerequisite: For music students, consent of instructor; foi non-music students, at least one year each of music history and music theory at the college level, or equivalent. Allen.

APPLIED MUSIC

Courses for Graduates and Advanced Undergraduates

360. Piano. Private lessons in piano on the advanced undergraduate and graduate level. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 160; qualifying examination for transfer students. Bradley, Branigan, Edwards, Fletcher, Richards, Schoonmaker, Stravinsky, Usry, Watt, Zirner.

361. Voice. Private lessons in singing on the advanced undergraduate and graduate level. I, II; ½ to 1 unit. S; ¼ unit. Prerequisite: Music 161; qualifying examination for transfer students. Bowen, Clark, Foote, Hamp, Kellogg, Miller, Stewart.

362. Organ. A repertoire course, using graded material, culminating in performance of the masterpieces of Bach, Franck, and Rheinberger; and selected works from the pre-Bach and contemporary periods. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 162; qualifying examination for transfer students. Miles, Pettinga.

363. Violin. Private instruction in violin on the advanced undergraduate and graduate level. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 163; qualifying examination for transfer students. Goodman, Rolland, Schmitt.

364. Viola. Private instruction in viola on the advanced undergraduate and graduate level. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 164; qualifying examination for transfer students. Garvey.

365. Cello. Private instruction in cello on the advanced undergraduate and graduate level. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 165; qualifying examination for transfer students. Potter, Swenson.

366. String Bass. Tuning by harmonics; development of flexibility in bowing; development of a practical working knowledge of the first six positions, also thumb positions; major and minor scales through higher positions; string ensemble and orchestra studies; solo repertoire and studies; study of various bowing styles. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 166; qualifying examination for transfer students. Edwards.

367. Flute. Private lessons in flute on the advanced undergraduate and graduate level. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 167; qualifying examination for transfer students. James, Putnik.

368. Clarinet. Private lessons in clarinet on the advanced undergraduate and graduate level. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 168; qualifying examination for transfer students. McDowell.

369. Oboe. Private lessons in oboe on the advanced undergraduate and graduate level. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 169; qualifying examination for transfer students. Ledet.

370. Bassoon. Private lessons in bassoon on the advanced undergraduate and graduate level. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 170; qualifying examination for transfer students. James.

371. Cornet and Trumpet. Private instruction in cornet and trumpet on the advanced undergraduate and graduate level. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 171; qualifying examination for transfer students. Sexton.

372. French Horn. Private instruction in French horn on the advanced undergraduate and graduate level. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 172; qualifying examination for transfer students. Howe.

373. Trombone. Private instruction in trombone on the advanced undergraduate and graduate level. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 173; qualifying examination for transfer students. Starr.

374. Baritone. Private instruction in baritone on the advanced undergraduate and graduate level. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 174; qualifying examination for transfer students. Starr.

375. Tuba. Private instruction in tuba on the advanced undergraduate and graduate level. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 175; qualifying examination for transfer students. Starr.

376. Percussion. Private instruction in percussion on the advanced undergraduate and graduate level. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 176; qualifying examination for transfer students. Price.

377. Harp. Private lessons for advanced undergraduates and graduates in harp. I, II; ¼ to 1 unit. S; ¼ unit. Prerequisite: Music 177, or qualifying examination in harp. Makris.

380. French Diction. Principles of French pronunciation applied to French vocal literature. Class and individual clinical analysis and practice. I; ¼ unit. Bowen.

381. French Diction. Principles of French pronunciation applied to French vocal literature. Class and individual clinical analysis and practice. II; ¼ unit. Prerequisite: Music 380; junior standing, or consent of instructor. Bowen.

382. Senior Diction. Preparation for senior recital; review of English, French, Italian, and German diction; stage deportment. I; ¼ unit. Prerequisite: Senior standing. Bowen.

383. Senior Diction. Preparation for senior recital; review of English, French, Italian, and German diction; stage deportment. II; ¼ unit. Prerequisite: Music 382; senior standing, or consent of instructor. Bowen.

PHILOSOPHY

The Department of Philosophy offers graduate work leading to the Master of Arts and Doctor of Philosophy degrees.

Students undertaking graduate work with philosophy as their major subject are required to have had a grade-point average of at least 3.5 for that portion of the work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students otherwise qualified may be admitted on limited status. In addition, students majoring in philosophy should have had a course in logic, a course in ethics, and a general course in the history of philosophy. Those with deficiencies may be required to fill them by taking Philosophy 102 (or 333), 321, or 303-306, respectively, in addition to the minimum requirement of eight units for the master's degree.

Degree of Master of Arts. A candidate for this degree must choose at least one course in each of the following three fields: history of philosophy; theory of knowledge, including logic and philosophy of science; and theory of value, including ethics and esthetics. In addition to completing eight units of graduate work, the candidate must take an oral examination on the work represented by these units. His adviser will arrange and preside at this examination. Applications to the Dean to have the thesis requirement waived will not be approved except on recommendation of the adviser and vote of the Department.

Degree of Doctor of Philosophy. A candidate for this degree must choose at least two courses in each of the following three fields: history of philosophy, theory of knowledge, and theory of value.

Major subjects may be chosen from the following: (1) history of philosophy; (2) theory of knowledge, including logic and philosophy of science; (3) theory of value, including ethics, social philosophy, and esthetics.

Minor subjects may be chosen from the above or may be more restricted in scope: e.g., metaphysics, philosophy of law, any subtopic in (2) or (3) above, or a shorter period or particular movement in the history of philosophy. In general, however, the Department recommends a single minor outside the Department rather than two minors, one within and one outside. The candidate's choice of minor or minors must be approved by the Department on recommendation of the adviser.

The preliminary examination for the doctor's degree, in addition to the major and minor subjects, will presuppose first-hand acquaintance with at least one major work of Plato, Aristotle, Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume, Kant, and Hegel, and such an acquaintance with the history of philosophy in general as may be obtained from a standard textbook history.

The details of the special departmental requirements for graduate degrees can be obtained in mimeographed form by addressing a request to the Department, 119 Lincoln Hall.

Assistantships

The Department has available each year a limited number of half-time and quarter-time teaching assistantships for properly qualified graduate students. Applications should be sent directly to the Department, not later than March 1 of the scholastic year preceding that for which application is made.

Graduate Teaching Faculty

Professors: M. T. McClure (Head of Department), M. H. Fisch (on leave 1950-1951), D. W. Gotshalk.

Associate Professors: B. Mates (Visiting), J. A. Nicholson, A. R. Turquette (on leave first semester 1950-1951), F. L. Will.

Assistant Professors: B. J. Diggs, O. A. Kubitz.

Instructor: L. Linsky (on leave first semester 1950-1951).

Courses for Graduates

401. Seminar in Ancient Philosophy. Topic: Greek and Roman Stoics and Sceptics. I; 1 unit. McClure.

402. Seminar in Ancient Philosophy. Topic: Aristotle. II; 1 unit. Fisch.

405. Seventeenth Century Continental Thought (Descartes, Spinoza, Leibniz). A study of the basic philosophical works of the three leading continental thinkers of the century. I; 1 unit. Gotshalk.

407. British Empiricism. I or II; 1 unit. Gotshalk.

408. German Idealism (Kant). II; 1 unit. McClure.

409. Recent American Philosophy. Major American philosophers and movements since about 1900. I; 1 unit. Offered in 1951-1952 and in alternate years. Fisch.

411. Recent Ethical Theory. I; 1 unit. Fisch.

413. Logical Theory. Logical syntax and semantics. II; 1 unit. Prerequisite: A course in logic, or consent of instructor. Turquette.

421. Seminar in Contemporary Problems. Intensive study of selected problems on topics in contemporary philosophy, with particular emphasis on questions of knowledge and value. I; 1 unit. Offered in 1951-1952 and in alternate years. Will.

422. Seminar in Contemporary Problems. Intensive study of selected problems on topics in contemporary philosophy, with particular emphasis on questions of knowledge and value. II; 1 unit. Offered in 1951-1952 and in alternate years. Fisch.

423. Seminar in Theory of Knowledge. Selected topics and writings of major importance in the contemporary philosophy of knowledge. I; 1 unit. Will.

424. Seminar in Theory of Knowledge. Selected topics and writings of major importance in the contemporary philosophy of knowledge. II; 1 unit. Will.

493. Research. Research in special topics. I; ½ to 2 units. Staff.

494. Research. Research in special topics. II; ½ to 2 units. Staff.

Courses for Graduates and Advanced Undergraduates

303. History of Greek and Roman Philosophy. I; ½ to 1 unit. McClure and others.

304. History of Medieval Philosophy. Lectures and readings in the history of philosophy from St. Augustine to William of Ockham. II; ½ to 1 unit. Diggs.

306. History of Modern Philosophy. II; ½ to 1 unit. McClure and others.

309. The Philosophy of Plato. I; ½ to 1 unit. Nicholson.

311. Philosophical Ideas of the Nineteenth and Twentieth Centuries. I, II; ½ to 1 unit. Fisch.

313. American Philosophy. The history of philosophy in America from colonial times to the present. I; ½ to 1 unit. Fisch.

316. Three Philosophical Poems. Lucretius, *Of the Nature of Things;* Dante, *Divine Comedy;* Goethe, *Faust;* studied as literary expressions of three major movements in European thought: Greek naturalism, medieval supernaturalism, and modern romanticism. I; ½ to 1 unit. Offered in 1951-1952 and in alternate years. Fisch.

317. Great Books in Modern Thought (Hume, Darwin, Marx, Freud). Reading and discussion of selected books which either have produced or themselves reflect in some important way a changed conception of man and the world. I; ½ to 1 unit. Will.

321. Ethics and Value Theory. I; ½ to 1 unit. Fisch.

323. Philosophy of Art. A discussion of the main philosophical principles of art and of outstanding contemporary philosophies of art. I; ½ to 1 unit. Gotshalk.

324. Philosophy of Religion. II; ½ to 1 unit. Nicholson.

326. Metaphysics. II; ½ to 1 unit. Prerequisite: One course in philosophy.

328. Philosophy of Science. A study of some philosophical problems that have developed from modern science. II; ½ to 1 unit. Carnap.

330. Theory of Knowledge. The relative acceptability of authority, intuition, and the method of hypothesis as ways of establishing belief; logical and empirical truth; pragmatism and positivism; other selected contemporary topics. II; ½ to 1 unit. Will.

333. Symbolic Logic. A study of the elementary principles of symbolic analysis as applied to logical problems. I; ½ to 1 unit. Turquette.

334. Symbolic Logic. A general study of the more refined methods of symbolic analysis as applied to logical problems. Particular attention is devoted to proof procedures as they relate to the question of consistency and completeness. II; ½ to 1 unit. Prerequisite: Philosophy 333 or consent of instructor. Offered in 1950-1951 and in alternate years. Turquette.

336. Philosophy of Law and of the State. II; ½ to 1 unit. Fisch.

337. Semantics. An investigation of semantical concepts such as denoting and truth. A study of the functions of language, definition, meaning and verification, semantical paradoxes. I; ½ to 1 unit.

350. Philosophy of Contemporary Life. II; ½ to 1 unit. Gotshalk.

PHYSICAL EDUCATION

The Department offers graduate work leading to the Master of Science and the Doctor of Philosophy degrees. The program is centered in training teachers, administrators, and research workers in the field of physical education but also offers opportunities for special training in several related fields, notably, health education, safety education, kinesitherapy, recreation, sports, camping and outdoor education.

Admission requirements for a major in the Department are: (a) a minimum grade-point average of 3.5 (half way between B and C) for that portion of the work which represents the last fifty per cent of the hours earned for the bachelor's degree, exclusive of required courses in physical education and military training; (b) thirty hours of approved undergraduate credit in physical education

Health Education Students
Conducting an Eye Screening
Test for Local School Children

or related fields; (c) eighteen hours of approved undergraduate credit in science; (d) sixteen hours of undergraduate credit in education; and (e) a course in measurement or statistics. Students are not admitted on limited status.

Admission requirements for a minor in the department are twenty hours of physical education. Students who do not meet this requirement, however, may be admitted to certain courses, if approved by the instructor.

Master of Science in Physical Education. Graduation requirements for this degree are eight units (equivalent of thirty-two hours credit) to include: (a) four units of credit in physical education courses; (b) two units of credit in education courses (Education 409, Advanced Educational Psychology, plus one other approved course); (c) registration in and satisfactory completion of Physical Education 490, Seminar, for one semester, no credit; (d) presentation of an acceptable thesis, two units.

Candidates may petition to waive the thesis and seminar requirements. Those who are excused are required to secure two units' credit in lieu of thesis credit (item d) and in addition are required to take and pass a final comprehensive written examination in physical education.

Doctor of Philosophy in Physical Education. Graduation requirements for this degree are twenty-four units of graduate credit (equivalent of ninety-six hours of credit) including: (a) a minimum of eight units of credit in physical education courses; (b) one minor for a minimum of four units, or two minors for a minimum of two units each; (c) registration in and satisfactory completion of Physical Education 490; and (d) presentation of an acceptable thesis for approximately eight units.

Each candidate must pass a reading examination in French and German. No student will be considered as beginning his second year of graduate work until he has passed one of these examinations. Both examinations must be passed before taking the preliminary examination.

Each candidate must pass a combined written and oral examination covering his major and minor fields of study. This preliminary examination will be given toward the end of the second year of study, or, by special permission, at the beginning of the third year (not later than November 1).

Each candidate must pass a final examination, principally on his thesis. This examination must be taken at least two weeks before the degree is to be conferred.

Any one wanting additional information about these programs should write to the Director of the School of Physical Education, University of Illinois, 108 Huff Gymnasium, Champaign, Illinois.

Assistantships

A limited number of part-time teaching assistantships and part-time research assistantships are available in Physical Education. These appointments are made annually and are open only to candidates for advanced degrees. Candidates for these positions must have a B grade average for the last two years of undergraduate study.

Graduate Teaching Faculty

Professors: S. C. Staley (Director of the School of Physical Education), T. K. Cureton, H. W. Hoyman, Laura J. Huelster, C. O. Jackson, G. T. Stafford.

Assistant Professors: R. H. Johnson, C. G. Knapp.

Instructor: A. W. Hubbard.

Courses for Graduates

(Open to both men and women)

400. Problems in Public Health. Deals with the basic facts and principles of public health at the local, state and national levels; including the relationships between public health departments, voluntary health agencies, and the schools. I or II; 1 unit. Hoyman.

401. Problems in Physical Education. Devoted to problems involved in organizing and conducting effective curricula in physical education; physiological, social, and psychological implications of physical education; selection and distribution of activities; facilities and equipment; teacher preparations; professional advancement; literature; research problems. I or II; 1 unit. Jackson, Johnson, Staley.

402. Problems in Safety Education. Philosophy of safety; traffic, recreation, home, and industrial safety facts and figures; the safety problem and its relation to education; organization and administration of safety education programs; preparation of teaching personnel; methods of teaching; legal aspects; research problems. I or II; 1 unit. Stafford.

403. Problems in Health Education. Deals primarily with the history, philosophy, principles and practices of school health education in its three main phases; health service, healthful school environment, and health instruction, including evaluation. I or II; 1 unit. Hoyman, Jackson, Stafford.

404. Problems in Recreation. Concerned with the history, scope, function, and organization of public and private recreation. Covers national, state, county, municipal, and rural programs; legal status, financing, administration. I or II; 1 unit.

406. Philosophy of Sport. Reviews the history of sport; cultural, social, hygienic, educational, character, personality, therapeutic and military implications; organization of sports programs; literature; research programs. I or II; 1 unit. Johnson, Staley.

407. Sports Psychology. Considers some of the processes by which patterns of behavior important in physical education and sports are formed; interpretation of participant behavior in sports; literature; research problems. I or II; 1 unit. Prerequisite: Psychology 100; Education 409; consent of instructor. Hubbard.

450. Trends and Techniques in Rehabilitation. Philosophy of rehabilitation; problems in the education of the handicapped (blind and partially sighted, deaf and hard of hearing, the educable mentally handicapped, the socially maladjusted, orthopedic crippled, cardiac, epileptic, speech deviate, etc.); state and federal plans for education and vocational training of handicapped children and adults; community rehabilitation centers. I or II; 1 unit. Stafford.

451. Scientific Foundations of Physical Fitness. Scientific basis and contemporary developments of educational programs in physical fitness; programs of governmental and private organizations; analysis of physical fitness tests; techniques used in physical fitness testing and remedial clinics. I or II; 1 unit. Prerequisite: Undergraduate anatomy, physiology, measurement or statistics. Cureton.

452. Scientific Analysis of Physical Education Activities. Analysis of a selected number of physical education activities by the application of principles and methods of advanced physiology of exercise, mechanics, and kinesiology, reducing the movements to physical equations or the scientific

laws which apply. I or II; 1 unit. Prerequisite: Anatomy, physiology, kinesiology, elementary physics, algebra, and trigonometry. CURETON.

453. ANTHROPOMETRICAL AND BODY MECHANICS RESEARCH TECHNIQUES IN HEALTH AND PHYSICAL EDUCATION. Critical analysis of the techniques of anthropometrical and body mechanics measurements including both physical and statistical aspects; will include analysis of procedures used in research studies completed in this area; laboratory and computational projects in biophysical aspects. I or II; 1 unit. CURETON.

490. SEMINAR. Lectures, discussions, and critiques on physical education, health, safety, kinesitherapy, recreation, sports, camping, outdoor education, and related subjects by faculty members and visiting professional leaders. Presentation of theses by students. I, II; no credit. CURETON, STAFFORD, STALEY.

491. THESIS. Open only to students engaged in preparing theses. Amount of credit is adapted to each individual's case. I; ½ to 4 units. CURETON, HOYMAN, HUELSTER, JACKSON, STAFFORD, STALEY.

492. THESIS. Open only to students engaged in preparing theses. Amount of credit is adapted to each individual's case. II; ½ to 4 units. CURETON, HOYMAN, HUELSTER, JACKSON, STAFFORD, STALEY.

493. RESEARCH. Independent research in special projects. Open only to students working toward doctor's degree. I; ½ to 2 units. CURETON, HOYMAN, STAFFORD, STALEY.

494. RESEARCH. Independent research in special projects. Open only to students working toward doctor's degree. II; ½ to 2 units. CURETON, HOYMAN, STAFFORD, STALEY.

495. TECHNIQUES OF RESEARCH IN HEALTH, PHYSICAL EDUCATION, AND RECREATION. Review and appraisal of the more common research procedures and literature in the fields of physical education, health, safety, kinesitherapy, recreation, sports, camping, and outdoor education. Attention will be given to applications of statistical procedures, library methods, survey procedures, evaluation procedures, and experimental methods. I or II; 1 unit. CURETON, HUBBARD.

PHYSICAL SCIENCES

A special program leading to the degree of Master of Science in the Physical Sciences is available to meet the needs of students who wish to get a broad view of the physical sciences rather than to specialize in one department. Since it is designed primarily for those preparing to teach the physical sciences, chemistry and physics are emphasized. Students working toward a degree under the provisions of this program are expected to seek approximately equal proficiency in both physics and chemistry; those whose undergraduate work has emphasized chemistry should balance this by weighting the graduate work in favor of physics, and vice versa. No thesis is required, and all courses in physics, chemistry, geology, astronomy, and mathematics which normally give graduate credit will carry credit toward the degree. To qualify for the degree, a student must have had, or must include in his program, at least one course in mathematics beyond the calculus, and for which the calculus is prerequisite.

Candidates for the degree of Master of Science in the Teaching of the Physical Sciences must earn four units in the physical sciences, two units in education, and two units in electives. Requirements are the physical sciences, four units; education, two units, including two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of

Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit. The courses in the physical sciences and the electives must be selected with the approval of the adviser. The electives may be in the physical sciences, in education, or, in exceptional cases, in other fields. Students applying for admission must have a grade-point average of at least 4.0 for that portion of work which represents the last fifty per cent of the hours earned for the bachelor's degree, exclusive of required courses in physical education and military training. Students on limited status will not be admitted. The adviser for candidates for this degree is Professor J. C. Bailar, Jr., 107 Chemistry Annex.

PHYSICO-CHEMICAL BIOLOGY

Training for the degree of Doctor of Philosophy in Physico-Chemical Biology is administered by a committee of the Division of Biological Sciences. The chairman of this committee is Professor Robert Emerson, 155 Natural History Building. The purpose of this curriculum is to offer students who wish to prepare for a career in biological research, a training which combines courses in physics and chemistry with study of the fundamentals of biology as illustrated by some natural group of organisms. The majority of biological work will ordinarily be in one of the biological departments (Bacteriology, Botany, Physiology, Entomology, Zoology), but may be divided among these fields to suit the needs of the candidate.

Research facilities are available in cellular physiology, microbiology, photosynthesis, electrophysiology, diffusion processes, and radiobiology.

Applicants for admission must have a grade-point average of at least 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Under exceptional circumstances, a student with a lower grade-point average may be admitted on limited status.

Minimum admission requirements are college biology (six hours), college physics (eight hours), analytical and organic chemistry, and calculus. Deficiencies in any of these requirements may be made up during the first year of graduate study, but no graduate credit will be given. A total of six hours of calculus will be needed as prerequisite for the physics requirement listed below.

All candidates are required to take the following courses, or show equivalent credits:

Chemistry: Chemistry 240 (Physical Chemistry), and either 350 (Biochemistry) or 336 and 337 (Organic Chemistry).

Physics: Two units from Physics 341, 342 (Electricity); 270, 371, 372, 373, 374 (Light); 360 (Heat); 281, 381 (Atomic Physics); 362 (Nuclear Physics).

Cytology or Genetics: One unit from either Zoology 403 (Cytology); or 351 and 352 (Genetics); or Botany 320 or 322 (Genetics); or Botany 420, 421 (Cytogenetics).

Physiology: One unit from either Physiology 306 or 307 (Mammalian Physiology); 341 (Comparative Physiology); 342 (Cellular Physiology); Botany 333, 335, or 433 (Plant Physiology); or Entomology 324 or 325 (Insect Physiology), Bacteriology 403 (Bacterial Physiology).

Advanced Biology: Two units from among the following courses: Zoology 333 (Embryology), 320 (Invertebrate Zoology), 318 (Protozoology), 334 (Histology), 322 (Advanced Vertebrate Anatomy); Botany 304 (General Morphology), 345 (Plant Anatomy), 322 (Heredity and Evolution), 372 (Mycology), 402 (Physiological Genetics), 472 (Industrial Molds and Fermentations), 340 (His-

tology, Microtechnique); Bacteriology 320 (General Bacteriology), 403 (Physiology of Bacteria); Entomology 322 (Insect Bionomics) or 407 (Insect Anatomy).

Eight additional units are to be chosen from selected areas of biology, physics, chemistry, or mathematics.

It is expected that all students in the curriculum will take Biological Science 331, 332, and 333 (Radiobiology, Photobiology, and Electrobiology), and Biological Science 354 (also listed as Physics 354, Biophysics Laboratory). Other courses suitable to supplement the curriculum are: Physics 351, 352 (Biophysics); Bacteriology 405 (Microbiological Genetics); Chemistry 450 (Intermediary Metabolism); Physiology 462 (Advanced General Physiology); Zoology 455 (Physiological Genetics); Botany 419 (Photosynthesis and Related Subjects).

If some of the above requirements have already been fulfilled by undergraduate work, the student must submit for approval of the committee additional work in the same or other field of equivalent credit.

After completion of a minimum of sixteen units of graduate work, a written preliminary examination will be required. This will be followed by an oral examination given by a committee appointed by the Dean of the Graduate College. For students transferring from other universities, at least one semester of graduate work at the University of Illinois will be required before admission to the preliminary examination.

Subject to approval by the committee, candidates for the degree of Doctor of Philosophy in other fields may take a minor in Physico-Chemical Biology.

Fellowships and Assistantships

Fellowships and teaching and research assistantships are available in this field. Applications for fellowships should be made on forms provided by the Graduate College and should be forwarded to the Dean of the Graduate College. Applications for assistantships should be made on forms provided by the Chairman of the Committee for Physico-Chemical Biology.

PHYSICS

The Department of Physics offers graduate work leading to the Master of Science and Doctor of Philosophy degrees.

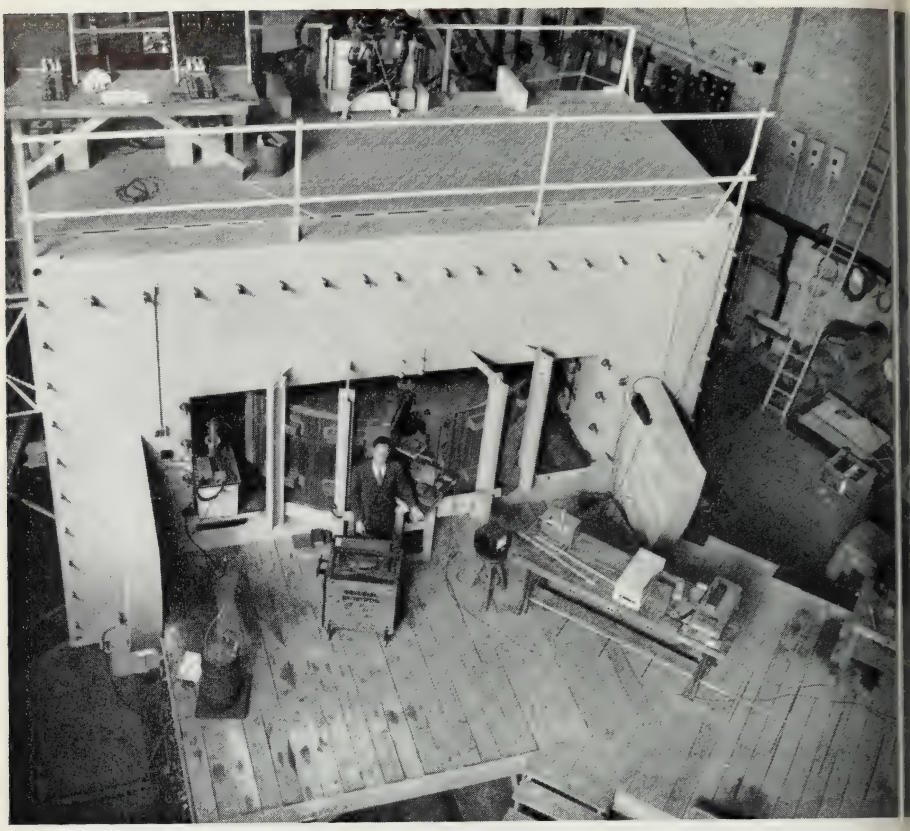
There is opportunity for specialization in nuclear physics, including research with the betatrons, the cyclotron, and with radioactive sources; in nuclear magnetic resonance; in cosmic rays; in theoretical physics; in the physics of solids, including research on metals, semi-conductors and cryogenics; and, to a limited extent, in biophysics.

The requirements for admission to the Graduate College with a major in physics are: twenty semester hours of courses in physics, including Physics 321, 341, and 342 or the equivalent, and excluding courses in general physics and others numbered below 270; a grade average of at least 3.75 for that portion of the work which represents the last fifty per cent of the hours completed for the bachelor's degree, exclusive of required courses in physical education and military training. Students on limited status will not be admitted.

Students who lack some of the prerequisite courses may be admitted but will be required to take the prerequisite courses without graduate credit.

Students admitted to the Graduate College with a major in another department may, with the consent of their adviser, elect a minor in physics provided they satisfy the prerequisites for the physics courses they elect.

The requirements for the Master of Science degree in physics are the general requirements of the Graduate College. They may be satisfied by adequate performance in graduate courses, without the submission of a thesis.



The Recently Completed 300-Million Volt Betatron with the Original Model in the Foreground

Departmental requirements for the degree of Doctor of Philosophy in Physics, in addition to the general requirements of the Graduate College, are described in an informal pamphlet obtainable from the office of the Head of the Department. This pamphlet also contains fuller descriptions of the courses in physics and related courses in mathematics and suggestions as to appropriate course sequences.

Candidates for the degree of Master of Science in the Teaching of Physics must earn four units in physics, two units in education, and two units in electives. Requirements are physics, four units; education, two units, including two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit. The courses in physics and the electives must be selected with the approval of the adviser. The electives may be in physics, in education, or, in exceptional cases, in other fields. Students applying for admission must have the same grade-point average as required by the Department. Those on limited status will not be admitted to this program. The adviser for candidates for this degree is Professor R. F. Paton, 206 Physics Laboratory.

Assistantships

The Department employs a number of half-time graduate teaching and research assistants. Inquiries about and applications for these positions should be addressed to the Head of the Department. Research assistants are expected to be advanced graduate students or to have technical experience of value to the research programs of the Department.

Graduate Teaching Faculty

Professors: F. W. Loomis (Head of Department), G. M. Almy, J. H. Bartlett, S. M. Dancoff (on leave 1950-1951), D. W. Kerst, P. G. Kruger, A. T. Nordsieck, L. N. Ridenour, F. Seitz.

Associate Professors: J. S. Allen, R. B. Duffield, A. O. Hanson, R. D. Hill, J. S. Koehler, A. Longacre (on leave 1950-1951), E. M. Lyman, R. J. Maurer, R. F. Paton, H. Quastler, C. W. Sherwin.

Assistant Professors: G. D. Adams, P. Axel, R. A. Becker, J. M. Blatt, R. I. Hulsizer, R. D. Rawcliffe, C. S. Robinson.

Instructors: C. P. Slichter, J. N. Snyder.

Courses for Graduates

400. Problems and Methods of Theoretical Physics. Vector analysis. Boundary value problems. The equations of mathematical physics; variational derivation; contour integration; ordinary differential equations; boundary conditions; Green's functions; Eigen's functions; Laplace's and Poisson's equations in one, two and three dimensions; conformal mapping; integral representation; asymptotic expansions. I; 1 unit. Prerequisite: Mathematics 342, or 345, or 347, or 387; Physics 322 and 342, or consent of instructor. Blatt.

403. Experimental Research Techniques. This course is intended to bridge the gap between the undergraduate laboratory work and actual research in experimental physics. The student is introduced to the elements of glass-blowing and machine shop practice. There are experiments on the produc-

tion and measurement of high vacuums, the detection of single particles, the measurement of small currents, x-rays, nuclear induction, and a number of other problems in nuclear and atomic physics including nuclear spectroscopy and mass spectroscopy. The student has wide latitude in selecting the experiments and techniques which interest him. I, II; 1 unit. Prerequisite: Physics 343 and 374; consent of instructor. SHERWIN.

404. EXPERIMENTAL RESEARCH TECHNIQUES. Continuation of Physics 403. The student usually selects a more advanced research project which he pursues for most of the semester. I, II; 1 unit. Prerequisite: Physics 403. SHERWIN.

422. DYNAMICS. LaGrange equations, small vibrations; Hamilton's canonical equations; Hamilton's principle, least action; contact transformations; Hamilton-Jacobi equation; perturbation theory; non-linear mechanics. II; 1 unit. Prerequisite: Physics 322; Mathematics 345. BARTLETT.

424. GENERAL RELATIVITY. Same as Mathematics 460. The general theory of relativity and cosmogony. I; 1 unit. Prerequisite: Consent of instructor. BLATT.

441. ELECTRODYNAMICS. Electrostatics; Poisson's equations, Laplace's equation; boundary value problems; spherical harmonics; multipole potentials. Dielectrics; microscopic and macroscopic fields; susceptibility. Magneto-statics: vector potential, magnetic multipoles. Magnetic media: ferro-, dia-, paramagnetism. Conducting media. Maxwell's equations: field energy and momentum; retarded potentials. Fields due to moving charges: Lienard-Wiechert potential; fields of an accelerated charge. I; 1 unit. Prerequisite: Physics 342, or equivalent; concurrent registration in Physics 400, or consent of instructor. KOEHLER.

442. ELECTRODYNAMICS. Continuation of Physics 441. Self force of a finite electron. Multiple radiation. Propagation of radiation in material media: wave guides; modes of propagation; skin effect. Special relativity. Lorentz-Abraham electron. II; 1 unit. Prerequisite: Physics 441. KOEHLER.

463. STATISTICAL MECHANICS. Statistical ensembles. The Maxwell-Boltzmann law. Approach to equilibrium. Quantum statistical mechanics. Application of statistical mechanics to thermodynamic processes. I; 1 unit. Prerequisite: Physics 422; Physics 360 or 362. NORDSIECK.

481. LINE SPECTRA AND ATOMIC STRUCTURE. A lecture course presenting Planck's law of radiation, the Bohr theory, de Broglie waves, and a brief introduction to wave mechanics. The course deals with the atomic nature of matter, elementary particles, the photo-electric effect, simple and complex atomic spectra, x-ray spectra, hyperfine structure, absorption, fluorescence, and ionization. II; 1 unit. Prerequisite: Physics 322, 342, and 372. AXEL.

483. NUCLEAR PHYSICS. Detection of nuclear radiations. Radioactive decay, natural radioactive isotopes, abundance of stable elements and stable isotopes. Rutherford scattering, interaction of nuclear radiations (excluding neutrons) with matter, nuclear transformations, nuclear masses. I; 1 unit. Prerequisite: Physics 481.

484. NUCLEAR PHYSICS. Excited states of nuclei, fast and slow neutrons, magnetic moments of nuclei, nuclear forces, artificially produced radioactive isotopes, theory of beta decay, resonance reactions, Bohr's drop model, fission. II; 1 unit. Prerequisite: Physics 483. BLATT.

485. QUANTUM MECHANICS. Schrödinger wave equation; stationary state solutions. Operators and matrices. Perturbation theory; non-degenerate and

degenerate cases. WKB approximation; non-harmonic oscillator, etc. Collision problems; Born approximation; method of partial waves. I; 1 unit. Prerequisite: Physics 481 and 422; Physics 400, or consent of instructor. SNYDER.

486. QUANTUM MECHANICS. Time dependent perturbation theory; elastic and inelastic scattering, absorption of light. Wave functions for identical particles, quantum statistics. Pauli spin operator. Classification of atomic states. Thomas-Fermi model. Quantization of radiation field. Interaction of light with matter. Dirac electron theory. II; 1 unit. Prerequisite: Physics 485. SNYDER.

487. ADVANCED QUANTUM MECHANICS. Second quantization. Fields of spin 0, ½, 1. Beta decay theory. Meson theory of nuclear forces. I; 1 unit. Prerequisite: Physics 486. BARTLETT.

488. THEORETICAL NUCLEAR PHYSICS. Quantum theory of nuclear structure and nuclear transformations. II; 1 unit. Prerequisite: Physics 485. NORDSIECK.

489. THEORY OF SOLIDS. This course reviews the introductory phases of the modern theory of crystalline materials. The experimental properties of solids are reviewed and individual types of solids are discussed on the basis of specialized models. This course may be taken without prior knowledge of wave mechanics. I; 1 unit. Prerequisite: Physics 485. SEITZ.

490. THEORY OF SOLIDS. Continuation of Physics 489. The quantum mechanical foundation of the field is treated with emphasis on the interrelations between the different types. II; 1 unit. Prerequisite: Physics 489. SEITZ.

491. COSMIC RAYS. A lecture course dealing with the interactions among particles, nuclei and radiation at high energies, and the interpretation of cosmic ray phenomena in terms of such interactions. I; 1 unit. Prerequisite: Physics 281, 342, or consent of instructor. HULSIZER.

493. RESEARCH. I, II; 1 to 4 units each semester.

498. SEMINAR. A course number occasionally used when it is desirable to give credit for individual but supervised study of a subject not covered by regular courses. Most of the actual seminars in the department are organized informally and without credit. I, II; 1 to 2 units.

Courses for Graduates and Advanced Undergraduates

321. THEORETICAL MECHANICS. Lectures and problems. Physics 321 and 322 are fundamental to many advanced courses, and should be elected as early as possible by those intending to specialize in physics. Laws of motion, vectors, statics, energy and momentum principles for a particle and for systems of particles, motion of a particle under constant forces, plane motion of a rigid body, simple harmonic motion and resonance, impact. I, II; 1 unit. Prerequisite: General physics and calculus. BECKER, SLICHTER.

322. THEORETICAL MECHANICS. Continuation of Physics 321. Motion of a particle under a variable force, central field motion, accelerated reference systems, motion of a particle subject to constraints, rotation of a rigid body in three dimensions, vibrating systems and normal coordinates, generalized coordinates. I, II; 1 unit. Prerequisite: Physics 321. BECKER, SLICHTER.

330. SOUND. Lectures and problems. Fundamentals of wave motion as related to sound and vibration; origin, propagation, interference, refraction, and diffraction of sound; vibration of strings and air columns. Some applications of sound theory; musical instruments, loud speakers, signalling and detecting

devices. Study of speech and hearing. II; 1 unit. Prerequisite: General physics and calculus.

341. Electricity and Magnetism. Lectures, problems, and laboratory. This course is fundamental to advanced courses and should be elected as early as possible by those intending to specialize in physics. Electrostatics, dielectrics, D.C. circuits and instruments, thermionic emission. I; 1 unit. Prerequisite: General physics and calculus; registration in Mathematics 341 or 343, or consent of instructor. Hanson, Lazarus.

342. Electricity and Magnetism. Continuation of Physics 341. Magnetic fields due to currents; self and mutual inductance; permeable media, hysteresis, para-, dia-, ferro-magnetism; motion of charge in electric and magnetic fields; A.C. circuits, transmission lines; Maxwell's equations, electromagnetic waves and radiation. II; 1 unit. Prerequisite: Physics 341. Hanson, Lazarus.

343. Vacuum Tube Circuits. Lectures, problems and laboratory. The physics of vacuum tubes, rectifiers and cathode-ray tubes and associated circuits. Elementary theory and applications of vacuum tubes as linear circuit elements in amplifiers and electronic instruments. Emphasis on experimental techniques. II; 1 unit. Prerequisite: Physics 341. Lyman.

344. Vacuum Tube Circuits. Continuation of Physics 343. Electronic instruments and techniques used in research in physics. Advanced theory and experiments emphasizing the use of vacuum tubes as non-linear circuit elements, e.g., multi-vibrators, blocking oscillators, pulse generators and amplifiers, Geiger counter circuits, synchronizing and time-measuring circuits. Familiarization with instruments and techniques used in research in physics. I; 1 unit. Prerequisite: Physics 343, or equivalent. Lyman.

351. Biophysics. Lectures and recitations. The nature of living systems: cells, chromosomes, and the reproductive cycle; effects of ordinary radiation on living matter: photochemical processes, bioluminescence; effects of penetrating radiation; transport processes: diffusion, electrolytic migration, permeability of living membranes (use of tracers), electrode phenomena, osmosis and growth. I; 1 unit. Prerequisite: General physics and calculus; consent of instructor. Bartlett.

352. Biophysics. Continuation of Physics 351. The mechanism of nerve conduction; structure of fibrous proteins as determined with the aid of X-rays and with polarized light; the mechanism of muscular contraction; the mechanism of vision: neural response, dark adaptation, color receptors. II; 1 unit. Prerequisite: Physics 351, or consent of instructor. Bartlett.

354. Biophysics Laboratory. Same as Biological Science 354. Laboratory experiments in optics, electricity and nuclear physics designed to familiarize the student with the physical apparatus and techniques useful in biophysics. II; 1 unit. Prerequisite: General physics, calculus, and one unit of advanced physics. Rawcliffe.

360. Heat and Thermodynamics. Lectures and recitations. Definition and measurement of thermodynamic functions such as temperature, entropy, enthalpy, etc. Heat conversion and transfer. Equilibrium and cyclic phenomena. Thermal radiation. Energy exchanges at very low and very high temperatures. II; 1 unit (½ unit for students who have credit for Physics 260). Maurer.

362. Kinetic Theory of Gases. A lecture and problem course presenting the theory of gases and treating such topics as the distribution law, viscosity, diffusion, thermal conduction, thermodynamic properties, and some of the

fundamentals of the statistical method. I, II; 1 unit. Prerequisite: General physics and calculus. MAURER.

371. LIGHT. Lectures. Geometrical optics with emphasis on application to instruments. Interference and diffraction. I; ½ unit. Prerequisite: General physics and calculus. ALMY.

372. LIGHT. Continuation of Physics 371. Electromagnetic character of light, Maxwell's equations, theory of reflection and refraction, polarization, double refraction, crystal optics, dispersion, scattering, optical properties of metals. II; ½ unit. Prerequisite: Physics 371. ALMY.

373. LIGHT LABORATORY. To accompany Physics 371. I; ½ unit. Prerequisite: Registration in Physics 371. ALMY, HULSIZER.

374. LIGHT LABORATORY. To accompany Physics 372. II; ½ unit. Prerequisite: Registration in Physics 372. ALMY, HULSIZER.

381. ATOMIC PHYSICS. A lecture and problem course presenting our modern knowledge of the several physical constants and of the nature and properties of atoms and atomic spectra, molecules and molecular spectra, electrons, light quanta, the photo-electric effect and the Compton effect. I; 1 unit. Prerequisite: General physics and calculus. KRUGER.

382. RADIOACTIVITY AND NUCLEAR PHYSICS. A lecture and problem course presenting our modern knowledge of the properties of nuclear particles, natural and artificial radioactivity, laboratory equipment for producing and studying high energy particles, nuclear disintegrations, the interaction of nuclear particles with each other and with matter, cosmic rays, and the application of nuclear phenomena to some practical problems. II; 1 unit. Prerequisite: Physics 381. KRUGER.

PHYSIOLOGY

The Department of Physiology offers graduate study leading to the degrees of Master of Science and Doctor of Philosophy.

To become a candidate for the degree of Master of Science, the student must meet the requirements of the Graduate College. The Department has no requirement concerning specific undergraduate major or minor fields, but does require that the student shall have taken as an undergraduate those courses which are prerequisite for the advanced courses ordinarily taken by candidates for the master's degree. That is, the candidate should have passed, as an undergraduate, the equivalent of fifteen hours of animal biology and twenty hours of chemistry. At the discretion of the Department's Graduate Committee, a candidate may be admitted on limited status, provided that he has passed all the courses required in the premedical curriculum.

To obtain the degree of Master of Science, the candidate must meet the general requirements of the Graduate College concerning grades, residence, and thesis. In addition the Department requires that he take at least four units of course work in physiology, at least two units outside the Department, and two units of research.

Permission to study toward the doctorate must be secured from the Graduate College and in addition, from the Department's Graduate Committee. The candidate must have passed the course work for a master's degree in physiology, or its equivalent, and must have on file in the Department office transcripts of his undergraduate and graduate record. Factors to be considered will be: (1) grades; (2) the results of the Graduate Record Examination, which the student is urged to take at the earliest opportunity; (3) the recommendation of his potential major

adviser; and (4) at the discretion of the Graduate Committee, a qualifying examination administered by the Department.

To obtain the degree of Doctor of Philosophy the candidate must comply with the general regulations of the Graduate College concerning grades, units of work, reading of two foreign languages, residence, thesis, preliminary examination, and final examination. The Department requires in addition that he pass a written, qualifying comprehensive examination in physiology before he is permitted to take his preliminary examination.

All candidates for the doctorate are urged to obtain as early as possible in their careers an adequate background at the undergraduate level in general zoology; comparative vertebrate anatomy; general botany; general bacteriology; general, inorganic, qualitative, quantitative, organic, and physical chemistry; general physics; analytic geometry, calculus, and elementary statistics. Among graduate courses that must be taken at some time in their careers are advanced mammalian physiology, comparative physiology, cellular physiology, neurophysiology, endocrinology, vertebrate embryology, genetics, vertebrate histology, and biochemistry. To complete the course work for the doctorate, graduate courses, of which a significant number shall be of the four hundred series, may be taken in the following fields: physiology, zoology, entomology, bacteriology, botany, physico-chemical biology, physics, chemistry, animal nutrition, animal science, psychology, mathematics, and other appropriate areas.

Eight to eleven units of research for the thesis are required, and may be conducted in one of several areas: cellular physiology, comparative physiology, mammalian physiology, electrophysiology, neurophysiology, radiobiology, endocrinology, environmental and stress physiology.

Assistantships

The Department appoints each year a number of graduate teaching and research assistants, with stipends set by the general regulations of the University. Inquiries concerning assistantships should be directed to the departmental office.

Graduate Teaching Faculty

Professors: R. E. Johnson (Head of Department), C. L. Prosser, F. R. Steggerda.

Associate Professors: H. Quastler, A. B. Taylor.

Assistant Professor: V. J. Wulff.

Courses for Graduates

453. Experimental Mammalian Physiology. A course to acquaint students with operative techniques that will be helpful in doing experimental mammalian physiology. II; 1 unit. Prerequisite: Consent of instructor. Steggerda.

454. Regulative Mechanisms in Behavior. Seminar in physiological aspects of regulative mechanisms and their reactions. Topic for 1950-1951: Mammalian reactions to stress. Topic for 1951-1952: Energy metabolism. I; ½ unit. Prerequisite: Consent of instructor. Johnson.

462. Advanced General Physiology Seminar. Same as Zoology 462. Lectures, reports, and discussions. Topic for 1951-1952: Physiological Adaptations as Evolutionary Factors. I or II; ½ unit. Prerequisite: Physiology 362, or equivalent. (Not offered in 1950-1951. Students should register in Physiology 333.) Prosser.

491. Research. I; ½ to 4 units. Staff.

492. Research. II; ½ to 4 units. Staff.
Research may be conducted in the following areas, with the consent of the instructor:

Cellular Physiology — Prosser, Taylor.

Comparative Physiology — Prosser.

Mammalian Physiology — Steggerda.

Electrophysiology and Neurophysiology — Prosser, Wulff.

Radiobiology — Quastler.

Endocrinology — Nalbandov (Department of Animal Science), Hall (Department of Zoology).

Environmental and Stress Physiology — Steggerda, Johnson.

495. Mammalian Physiology Seminar. Review of literature. I, II; ¼ unit. Steggerda.

Courses for Graduates and Advanced Undergraduates

305. Structure and Function of the Nervous System. An experimental approach to an understanding of nervous function. II; ½ to 1 unit. Prerequisite: One year of zoology or physiology; one year of physics. Wulff.

306. Advanced Mammalian Physiology. A review of topics on muscle, nerve, blood, and circulation pertaining to the field of mammalian physiology. I; 1 unit. Prerequisite: Twenty hours of chemistry, or consent of instructor. Steggerda.

307. Advanced Mammalian Physiology. A review of respiration, digestion, metabolism, excretion, temperature regulation, and endocrinology. II; 1 unit. Prerequisite: Twenty hours of chemistry, or consent of instructor; senior standing. Steggerda, Stolpe, Wulff.

331. Physico-Chemical Biology, Part I: Radiobiology. Same as Biological Sciences 331 and Botany 331. Action of ionizing radiations on living organisms. I; 1 unit. Prerequisite: One year of biology, physics, chemistry, and mathematics. Offered in 1951-1952 and in alternate years. Quastler.

333. Physico-Chemical Biology, Part III: Electrobiology. Same as Biological Sciences 333 and Botany 334. Potentials produced by and effects of potentials upon living organisms. Lectures, student reports, and demonstrations. II; ¾ unit. Prerequisite: Ten hours of biology; four hours of physical chemistry; ten hours of physics. Offered in 1950-1951 and in alternate years. Prosser.

361. Comparative Physiology. Same as Zoology 361. A comparison of the general physiology of different groups of animals. I; 1 unit. Prerequisite: Three semesters of zoology, or two of zoology and one of physiology. Elementary physiology and chemistry are recommended. Prosser.

362. Cellular Physiology. Same as Zoology 362. A physico-chemical analysis of biological functions common to most living cells. II; 1 unit. Prerequisite: One year of biology; three semesters of chemistry. Elementary physics is recommended. Prosser.

363. Endocrinology. Same as Zoology 363. The glands of internal secretion with special reference to the vertebrates. I; ½ unit. Prerequisite: One semester of elementary zoology or physiology; Zoology 334, or organic chemistry. Hall.

PLANT PATHOLOGY

Students may choose a major, joint major, or minor in plant pathology. Work for the degree of Master of Science or Doctor of Philosophy in Plant Pathology is administered by a committee appointed by the Dean of the Graduate College and representing the various departments which conduct research work in this field. Students considering training in this field should consult with some member of the staff in plant pathology as to their qualifications for entering this field for advanced degrees and to learn of opportunities for financial assistance during their training. Before registering, candidates must have the approval of the committee which consists of Dr. W. M. Bever (Chairman), Department of Agronomy; Dr. H. W. Anderson, Dr. M. B. Linn, Department of Horticulture; Dr. Leland Shanor, Department of Botany; and Dr. L. R. Tehon, State Natural History Survey.

The following fields are available for specialization in plant pathology: diseases of field crops, fruit crops, ornamentals, shade trees, and vegetable and canning crops. The student may also specialize in physiology of microorganisms, mycology, nematology, or plant virology.

A candidate for the Master of Science degree must meet the general requirements of the Graduate College and must present an acceptable thesis, unless this requirement is waived by petition, and pass an oral examination before a committee of five staff members. The examination will cover courses which the candidate has completed and in which he is currently registered. It is given the latter part of the second semester of residence.

Candidates for the Doctor of Philosophy degree must meet the general requirements of the Graduate College regarding foreign languages, special examinations, minors, and theses.

Beginning graduate students with a grade-point average of at least 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training, will be admitted to full status. Students will be admitted on limited status.

Graduate Teaching Faculty

Professors: H. W. Anderson (on leave second semester 1950-1951), B. Koehler, M. B. Linford, K. B. Raper, L. R. Tehon.

Associate Professors: W. M. Bever (Chairman), M. B. Linn, D. Powell, L. Shanor, H. H. Thornberry, F. F. Weinard.

Assistant Professors: J. W. Gerdemann, D. Gottlieb.

Courses for Graduates

404. Plant Virology. Same as Botany 404 and Horticulture 404. Fundamental concepts; classification, symptomatology; infectivity; biological, chemical, and physical properties; techniques for transmission, staining, assay, filtration, and purification; control methods; sources of information; history of virology. II; 1 unit. Prerequisite: Consent of instructor. Offered in 1951-1952 and in alternate years. Thornberry.

417. Discussions in Plant Pathology. Same as Botany 417 and Horticulture 417. Required for majors in plant pathology and as elective for graduate students in plant science. I, II; ¼ unit. Staff.

424. Seminar in Plant Virology. Same as Horticulture 424. Discussions and concise reports involving a critical analysis, evaluation, and review of original data in the literature with respect to the pathological, biological,

physical, and chemical aspects of virus nucleoproteins. I; ¼ unit. Prerequisite: Consent of instructor. THORNBERRY.

BOTANY 427. DISCUSSIONS IN MYCOLOGY. A seminar course designed for discussion of current research activities in the morphology, taxonomy, and physiology of fungi, especially the nonparasitic forms. I, II; ¼ unit. Prerequisite: Consent of instructor. SHANOR.

BOTANY 471. ADVANCED MYCOLOGY — SPECIAL GROUPS. Special groups of fungi and their activities are considered. Different groups for concentrated study may be selected each semester depending upon the student's interests in mycology. I, II; ½ unit. Prerequisite: Consent of instructor. SHANOR.

BOTANY 472. INDUSTRIAL MOLDS AND FERMENTATIONS. The characteristics, relationships, and activities of molds of industrial importance are considered, with special emphasis on the Aspergilli, Penicillia, Mucorales, and other saprophytic fungi. II; ½ unit. Prerequisite: Consent of instructor. RAPER.

491. THESIS. Same as Horticulture 491c and Agronomy 491b. Research on the thesis problem in plant pathology. I; ½ to 4 units. ANDERSON, BEVER, GOTTLIEB, KOEHLER, LINFORD, LINN, POWELL, THORNBERRY, WEINARD.

492. THESIS. Same as Horticulture 492c and Agronomy 492b. Research on the thesis problem in plant pathology. II; ½ to 4 units. ANDERSON, BEVER, GOTTLIEB, KOEHLER, LINFORD, LINN, POWELL, THORNBERRY, WEINARD.

493. RESEARCH. Same as Agronomy 493b, Botany 493e, and Horticulture 493c. Work may be taken in the following fields subject to approval of one of the staff: fruits, vegetable and canning crops, field crops, ornamentals, shade trees, virology, mycology, metabolism of microorganisms, nematodes. I; ½ to 4 units. ANDERSON, BEVER, GOTTLIEB, KOEHLER, LINFORD, LINN, POWELL, SHANOR, TEHON, THORNBERRY, WEINARD.

494. RESEARCH. Same as Agronomy 494b, Botany 494e, and Horticulture 494c. Work may be taken in the following fields subject to approval of one of the staff: fruits, vegetable and canning crops, field crops, ornamentals, shade trees, virology, mycology, metabolism of microorganisms, nematodes. II; ½ to 4 units. ANDERSON, BEVER, GOTTLIEB, KOEHLER, LINFORD, LINN, POWELL, SHANOR, TEHON, THORNBERRY, WEINARD.

Courses for Graduates and Advanced Undergraduates

BOTANY 372. GENERAL MYCOLOGY. Structure, classification, and identification of fungi, including those of economic importance. II; 1 unit. Prerequisite: One year of botany, bacteriology, entomology, or zoology; consent of instructor. SHANOR.

307. FRUIT DISEASES. Same as Botany 307 and Horticulture 307. Symptomatology; laboratory and field studies of representative diseases; control measures. I; ½ unit. Prerequisite: Plant Pathology 317 or Botany 372. Offered in 1951-1952 and in alternate years. ANDERSON.

308. VEGETABLE AND CANNING CROP DISEASES. Same as Botany 308 and Horticulture 308. Symptomatology; laboratory and field studies of representative diseases; control measures. II; ½ unit. Prerequisite: Plant Pathology 317 or Botany 372. Offered in 1950-1951 and in alternate years. LINN.

317. PLANT PATHOLOGY. Same as Agronomy 317, Botany 317, and Horticulture 317. Causes, diagnosis, and treatment of plant diseases. I; ½ unit. Prerequisite: One year of plant science, including Botany 100.

377. Diseases of Field Crops. Same as Agronomy 377 and Botany 377. A study of the symptoms of the major field crop diseases, life histories of causal organisms, and methods of control. II; ½ unit. Prerequisite: Botany 317 or Agronomy 121, or consent of instructor. Bever, Gerdemann.

379. Research Methods in Plant Pathology. Same as Agronomy 379, Botany 379, and Horticulture 379. Lectures and laboratory on the techniques for identification of plant diseases and their causal agents; for evaluation of plant protectants; for the study of the physiology of parasitism, and methods for planning research projects, evaluating data, and preparation of manuscripts for publication. I; ½ unit. Prerequisite: Botany 317. Gerdemann, Gottlieb, Thornberry.

POLITICAL SCIENCE

The Department of Political Science offers graduate work leading to the Master of Arts and Doctor of Philosophy degrees. Graduate work is conducted in the following special fields: American government and politics; state and local government; international law and relations; public administration; public law; comparative political institutions; political theory.

Candidates for advanced degrees in political science must have a grade-point average of at least 3.75 for that portion of the work which represents the last fifty per cent of the hours earned for the bachelor's degree, exclusive of required physical education and military training. Students will not be admitted on limited status. They must also have had a minimum of twenty hours of undergraduate work in political science, economics, sociology, and history, not less than twelve hours of which must have been in political science (which may include three hours in constitutional history). If a student making political science his major is taking both of his minors in other departments, one of them must be in history, economics, or sociology.

Several courses given in other departments are so closely related to those in political science that graduate students whose major is political science may be permitted on petition to take such courses as part of their major work. Attention is called to the courses in public law in the College of Law, the courses in public finance in the College of Commerce and Business Administration, the courses in city and regional planning in the College of Fine and Applied Arts, and the courses in municipal and sanitary engineering in the College of Engineering. An extension curriculum in public administration is offered at Springfield, designed particularly as in-service training for persons in the various state services and leading to the master's degree.

Graduate students in other departments who choose political science as a minor must have had at least six hours of undergraduate work in political science and three hours in economics, sociology, or history.

Fellowships

Professor John A. Fairlie, who served on the faculty of Political Science from 1909 to 1941, bequeathed to the University the sum of $20,000, the income of which is to be used as the stipend of the John A. Fairlie Fellowship in Political Science.

The Department participates with the Department of History in the Kendric C. Babcock Fellowship established under the will of Dean Kendric C. Babcock. For the third year these appointments carry a stipend of $1,000, and post-doctoral grants carry a stipend of $2,400. Nominations for these fellowships are made by

the heads of the departments of Political Science and History. Application forms may be obtained from the Graduate College office.

Graduate Teaching Faculty

Professors: C. M. Kneier (Chairman of Department), C. A. Berdahl, R. J. Dangerfield, L. L. Durisch (Visiting), J. M. Mathews, C. F. Snider, F. G. Wilson.

Associate Professors: C. B. Hagan, V. Jobst, E. G. Lewis.

Assistant Professors: J. M. Edelman, G. Manner, P. Monypenny.

Instructors: J. A. Ranney, R. E. Scott.

Courses for Graduates

400. Nature of the State. Principles, methods, and nature of political science; origin, forms, and functions of the state; sovereignty and liberty; organization and forms of government. S; 1 unit. Wilson.

401. The History of Political Theories. Reading and analysis of the leading political thinkers from the Greeks to the middle of the seventeenth century. I; 1 unit. Wilson.

402. History of Political Theories. Reading and analysis of the leading political thinkers from the middle of the seventeenth century to the present. II; 1 unit. Wilson.

406. Municipal Administration. Position of cities in American governmental system; governmental interrelationships; powers; services; current municipal problems. I or II; 1 unit. Kneier.

410. Problems in Rural Local Government. Research in selected topics. I or II; 1 unit. Snider.

412. State Government. Research in selected topics in American state government. II; 1 unit. Prerequisite: Political Science 312, or equivalent. Mathews.

420. Formation of Public Policy. Same as Labor and Industrial Relations 420. An examination of the institutional and dynamic forces that shape the making of policy and its administration in the United States; separation of powers, pressure groups, administrative and legal procedures, and judicial activity. I or II; 1 unit. Hagan.

421. Government and the Economic Order. Seminar in problems of government regulation of economic activity. This course is concerned with research materials, research papers, and related matters. I; 1 unit. Hagan.

426. Political Parties. Special problems in political parties; methods and materials of research in this field. I or II; 1 unit. Berdahl.

431. Problems in British Government. Special topics relating to British government. I or II; 1 unit. Lewis.

450. Contemporary Governmental Problems. Special problems of current importance. Designed especially for students not majoring in political science. S; 1 unit. Snider.

451. Constitutional Law. Research in selected topics in the American constitutional system. I; 1 unit. Prerequisite: Political Science 351, or equivalent. Mathews.

465. Problems in Administrative Management. An analysis of methods of applying administrative principles and procedures to operating problems in government agencies. Case studies will be made of such problems as methods of administrative coordination and control, intergovernmental cooperation, the role of nongovernmental organizations in executing administrative programs, the organization of regulatory functions, and review of administrative decisions. I or II; 1 unit. Prerequisite: Political Science 361 or 364, or consent of instructor.

466. Current Administrative Theory. A discussion of some recent trends in administrative opinion and practice on such questions as agency structure and functional activities; field and regional organization and relations; the role and functions of the executive; the process of decision making; the relations of line and staff activities; the communication and execution of policies and programs; and employee relations. II; 1 unit.

468. Governmental Communication and Reporting. Selected problems in the drafting of administrative orders and rules, the organization of public relations and informational and reporting services by government agencies, and the development of media for expressing the public's interest in governmental policies and programs. I or II; 1 unit. Prerequisite: Political Science 361 or 364, or consent of instructor. Durisch.

471. Problems in International Organization. Methods and materials of research in international organization; special topics, such as disarmament, security, procedural problems in the United Nations, economic and social problems, amendment and revision of the Charter. I or II; 1 unit. Berdahl.

481. Foreign Relations of the United States. Special problems in the development and conduct of American foreign policy. I; 1 unit. Dangerfield.

485. International Law. Research in selected topics. I; 1 unit. Jobst.

486. International Law. Research in selected topics. II; 1 unit. Jobst.

491. Seminar in Political Science and Public Law. Theses, special problems, reports, discussions, and criticism. I; ½ to 4 units. Staff.

492. Seminar in Political Science and Public Law. Theses, special problems, reports, discussions, and criticism. II; ½ to 4 units. Staff.

Courses for Graduates and Advanced Undergraduates

305. Municipal Government. Growth of cities; their legal status; municipal politics and organization in the United States. I; ½ to 1 unit. Kneier.

306. Municipal Problems. Municipal administration in the United States; administrative organization; personnel problems; financial problems, city planning and housing; police and fire administration; public health; public utilities. II; ½ to 1 unit. Prerequisite: Political Science 305, or Economics 102 and 103, or six hours of political science. Kneier.

310. Rural Local Government. Development of local government in rural America; state-local relationships; legal status of local units; organization and functions of counties, townships, school districts, and special-purpose districts; rural politics and elections; local finance; problems of reorganization. II; ½ to 1 unit. Snider.

312. Advanced State Government. Relations of the state with national, other state, and local governments; the state constitution and problems of revision; methods of popular control; nature, structure, powers, functions, and pro-

cedure of legislative, executive, judicial, and administrative organs of state government. II; ½ to 1 unit. Prerequisite: Political Science 150, or equivalent. MATHEWS.

315. LEGISLATURES AND LEGISLATION. The legislative function in government; structure and organization of American legislatures, national, state, and local; party organization in legislatures; legislative procedure, pressure groups and lobbying; relation of legislature to other branches of government; problems of legislative reorganization. I; ½ to 1 unit. Prerequisite: Six hours of political science.

321. GOVERNMENT AND THE ECONOMIC ORDER. A survey of public policies of national and state governments regulating economic activity; transportation, electrical utilities, communications, anti-monopoly, agriculture, level of economic activity. I; ½ to 1 unit. Prerequisite: Any two courses in political science, or a combination of political science and economics. HAGAN.

325. POLITICAL PARTIES: HISTORY AND ISSUES. Nature of American party system; historical development of parties and issues; third or minor parties and their role. I or II; ½ to 1 unit. BERDAHL.

326. POLITICAL PARTIES: ORGANIZATIONS AND METHODS. Organization and operation of the American party system; relations between national, state, and local organizations; state and national committees; the convention system; the primary; campaign methods and finance. I or II; ½ to 1 unit. BERDAHL.

331. BRITISH GOVERNMENT. Nature of the British constitution; the crown, ministry, and cabinet; Parliament and elections; the party system; law and the courts; local government; the British Commonwealth. I or II; ½ to 1 unit. LEWIS.

336. CONTINENTAL EUROPEAN GOVERNMENTS AND POLITICS. An analysis of the major political systems of continental Europe; constitutional and legal structures of France, Germany, Italy, the Soviet Union, and Spain; factors in the struggle for power; political and social movements as they affect the European scene; relation of political to economic, religious, and social institutions in Europe. II; ½ to 1 unit. LEWIS.

342. GOVERNMENT AND POLITICS IN LATIN AMERICA. A survey of the origin and development of Latin American political institutions; systems of government; public administrative systems; party government; international policies of Latin American governments. I or II; ½ to 1 unit.

343. INTERNATIONAL RELATIONS OF LATIN AMERICA. Latin American position and objectives in international affairs, with emphasis on the Latin American viewpoint; the Monroe Doctrine; the Good Neighbor Policy; the organization of American states and the United Nations; recent relations of specific nations. I or II; ½ to 1 unit. SCOTT.

345. THEORY AND PRACTICE OF DEMOCRATIC GOVERNMENT. Theories of the nature and conditions of democracy; contemporary democratic institutions compared and analyzed. I or II; ½ to 1 unit. Prerequisite: Political Science 150. RANNEY.

351. AMERICAN CONSTITUTIONAL SYSTEM. Judicial interpretation of constitution; separation of governmental powers; relation of state and national governments; control of interstate commerce; jurisdiction of courts. I; ½ to 1 unit. Prerequisite: Political Science 150. MATHEWS.

354. THE CONSTITUTION AND INDUSTRIAL LEGISLATION. Scope of national regulatory power; commerce clause, taxing power; spending power; scope of state regulatory power; police power and due process limitations. II; ½ to

1 unit. Prerequisite: Any two courses in political science, or a combination of political science and economics. HAGAN.

356. ADMINISTRATIVE LAW IN THE UNITED STATES. A study of the powers of administration, of the legal requirements for and the limits on the exercise of such powers, of the internal and external means of safeguarding individual rights, and of the enforcement of the responsibility of administrative officers both politically and legally. II; ½ to 1 unit. Prerequisite: Political Science 305, 351, 354, or 361 (any one), or consent of instructor. MONYPENNY.

359. JURISPRUDENCE. Nature and sources of law; law and the state; law and justice; evolution, arrangement and subject matter of law. I or II; ½ to 1 unit. Prerequisite: Political Science 150, or equivalent. MANNER.

361. INTRODUCTION TO PUBLIC ADMINISTRATION. Development of administrative organizations; administration and the executive, legislature, and judiciary; principles of organization, including line and staff relationships; the staff services of finance and personnel; formal and informal control. I; ½ to 1 unit. Prerequisite: Political Science 150. MONYPENNY.

364. NATIONAL ADMINISTRATION. Creation and development of the national administrative organization; the executive departments; regulatory, service, and staff agencies; special organization for emergency and war; efforts at reorganization and coordination. I or II; ½ to 1 unit. Prerequisite: Six hours of political science, including either Political Science 150 or 151.

365. ADMINISTRATION OF FEDERAL LABOR LAW. Same as Labor and Industrial Relations 365. Role of administration in the effectuation of public policy; organization and procedures of major federal labor agencies; types of policies formulated by federal labor agencies; experience of bureaus of Department of Labor, National Labor Relations Board, United States Employment Service, National Mediation Board, War Labor Board, and others. I or II; ½ to 1 unit. Prerequisite: Political Science 150. EDELMAN.

368. PUBLIC PERSONNEL ADMINISTRATION. Same as Labor and Industrial Relations 368. An analysis of personnel management in government. Such questions as recruitment and selection, job and salary classification, work standards, training, and the role of labor and professional organizations in the public service will be considered in the light of current theory and practice. I or II; ½ to 1 unit. Prerequisite: Political Science 361, or consent of instructor. DURISCH.

371. INTERNATIONAL ORGANIZATION. General development of world organization, forms of world organization, basic principles of international society, the problem of war, peaceful settlement of disputes. I or II; ½ to 1 unit. BERDAHL.

372. INTERNATIONAL ORGANIZATION. Principles, structure, methods, and actual operation of international governmental institutions; special attention to the League of Nations, the United Nations, and related agencies. I or II; ½ to 1 unit. BERDAHL.

373. INTERNATIONAL ADMINISTRATION. International administrative agencies; international unions and other agencies for functional purposes; organization, procedure, and personnel of international secretariats; budgets and financial administration; international territory; mandates and trusteeships. I or II; ½ to 1 unit. Prerequisite: Political Science 372, or equivalent. BERDAHL.

381. AMERICAN FOREIGN RELATIONS. Participation in international affairs; presidential initiative; development and organization of the Department of State;

diplomatic intercourse; consular service; treaty making power; development of foreign policy. II; ½ to 1 unit. Prerequisite: Six hours of political science. DANGERFIELD.

384. INTERNATIONAL RELATIONS. An examination of the nature of the national state system; of the forces affecting international relations; of the sources of conflicts in international politics; and of their solution by power politics or by international cooperation. I or II; ½ to 1 unit. MANNER.

385. INTERNATIONAL LAW. Nature, sources, and development of international law; rights and duties of states; law of peace and war. I; ½ to 1 unit. Prerequisite: Six hours of political science. JOBST.

386. INTERNATIONAL LAW. Continuation of Political Science 385. Nature, sources, and development of international law; rights and duties of states; law of peace and war. II; ½ to 1 unit. Prerequisite: Political Science 385, or consent of instructor. JOBST.

391. PRINCIPLES OF POLITICAL SCIENCE. A survey and analysis of the modern state; methods of study in political science; sovereignty and the legal nature of the state; forces and interests in politics; forms of government; the nature of democracy and international society. I; ½ to 1 unit. Offered in 1951-1952 and in alternate years. WILSON.

393. HISTORY OF POLITICAL THEORY. A survey of the major trends and issues in European political thought from ancient times to 1850. Greek and Roman theories of politics; the development of Christian political thought and the Middle Ages; political theory during Renaissance, Reformation, and the Counter Reformation; early modern absolutism, the emergence of constitutional government, and the theory of democracy; the Enlightenment, European liberalism, conservatism, Utopianism, and pre-Marxian socialism. I or II; ½ to 1 unit. WILSON.

396. CONTEMPORARY POLITICAL THEORY. Major tendencies in Western political theory since 1850; conservatism and constitutionalism; the religious interpretation of the state and economic institutions; Marxism, socialism, and communism; anti-democratic thought and totalitarian regimes. Students may not receive credit for both Political Science 396 and Philosophy 104. II; ½ to 1 unit. WILSON.

397. AMERICAN POLITICAL THEORY. A survey of American political thought from colonial times to the present. I; ½ to 1 unit. Offered in 1950-1951 and in alternate years. WILSON.

PSYCHOLOGY

The Department of Psychology offers graduate work leading to advanced degrees in the following three areas: Area I, Teaching and Research; Area II, Industrial Psychology; Area III, Clinical Psychology, including Counseling and Guidance.

Areas II and III correspond to the professional fields in which the American Board of Examiners in Professional Psychology awards diplomas, provided its standards of qualifications have been satisfied, usually as determined by oral and written examinations. In this connection, it is emphasized that the master's degree is not regarded as a terminal degree in the sense that it fulfills the academic preparation for becoming a professional psychologist. The educational purposes associated with Area III can not be realized short of four years (eight semesters)

of graduate training (including a year devoted to an internship). The Department of Psychology recommends that study in this area be pursued only by those students who intend to complete such a program.

To qualify for admission to the Graduate College with full graduate standing in psychology, a student must have had a minimum of sixteen semester hours in undergraduate psychology courses, including at least one undergraduate course in both statistics and experimental psychology (with laboratory). He must also have obtained a grade-point average no lower than 4.0 for that portion of undergraduate work representing the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. No student will be admitted on limited status. A student proposing to specialize in Area II or III must also have had in the case of Area II a course in applied or industrial psychology, and in the case of Area III a course in child psychology or child development and a course in clinical psychology. A student may be admitted to graduate work without having fully completed these prerequisites, but will then be required to devote a portion of his time to removal of his deficiencies.

To qualify for admission to a graduate minor in psychology, a student must have had a minimum of fourteen semester hours in undergraduate psychology, including a course in statistics.

In all areas, programs are provided which lead to the master's degree and to the Doctor of Philosophy degree. The master's degree offered for work completed in Area I or II, is that of Master of Arts; for work completed in Area III, it is that of Master of Science in Clinical Psychology. The requirements for the latter degree are completion of a year of work (a minimum of eight units) in the Urbana departments and an internship of six months in an institution, agency, or department recommended by the Department of Psychology and approved by the Dean of the Graduate College. No thesis is required. The work in Urbana shall include a minimum of four units in psychology and two units to be chosen from education and sociology. A departmental requirement for the degree of either Master of Arts or Master of Science in Clinical Psychology is the passing of a comprehensive written examination in the general field of psychology. This examination must be passed by candidates for the degree of Master of Science before entering upon the internship.

A departmental requirement for the degree of Doctor of Philosophy, in the case of students following the program of Areas II and III, is a year's internship. This internship normally constitutes the third year of work and must be certified as satisfactorily completed by an approved institution. While data for the doctor's thesis may in some cases be secured during the internship, an additional year is normally required for writing the thesis and carrying out the research on which it is based.

Practice courses (or practicums) are offered which provide practical work in the Student Counseling Bureau, the Office of Nonacademic Personnel, and the Psychological Clinic. The staff of the Psychological Clinic includes, in addition to clinical psychologists, a part-time psychiatrist and a full-time psychiatric social worker. Other facilities for graduate work include a statistical laboratory, an animal laboratory, and well-equipped laboratories for research in experimental psychology and in aviation psychology. The Department also makes extensive use, particularly for internships, of facilities provided by the Institute for Juvenile Research and by a number of Illinois state hospitals. The Veterans Administration Hospital in Danville, Illinois, is used both for internships and practice courses by students who have been admitted to the Veterans Administration program for training in clinical psychology.

Fellowships and Assistantships

The Department of Psychology recommends each year a small number of students for United States Public Health Service training stipends. The amount of these stipends, given only to qualified students specializing in clinical psychology, is $1,200 for first-year graduate students and increases by $400 a year to $2,400 for fourth-year graduate students. Acceptance of one of these stipends does not entail any duties of teaching or service, and appointees are ordinarily given the rank of fellows. The Department also participates in the program for graduate training in clinical psychology of the United States Veterans Administration. In connection with this program, the Department recommends each year a small number of students for appointment as part-time interns. A small number of students are also appointed as part-time interns in the Psychological Clinic of the Department of Psychology.

A number of teaching and research assistants are appointed each year. Information concerning these may be obtained by inquiry addressed to the Department of Psychology, 314 Gregory Hall.

Graduate Teaching Faculty

Professors: L. H. Lanier (Head of Department), R. B. Cattell, G. D. Higginson, L. I. O'Kelly, L. L. McQuitty, O. H. Mowrer, R. Stagner, H. Woodrow (on leave first semester 1950-1951), P. T. Young.

Associate Professors: R. M. Collier, W. M. Gilbert, T. W. Harrell, L. A. Hellmer, A. L. Irion, W. G. McAllister, C. E. Osgood, A. C. Williams.

Assistant Professors: J. B. Cohen, T. N. Ewing, H. A. Grace, G. R. Grice, A. K. Jonietz, D. S. Pomeroy.

Courses for Graduates

404. Physiological Psychology. I, II; 1 unit. Prerequisite: Psychology 211 and 278, or consent of instructor. O'Kelly.

406. Quantitative Methods. Methods of inductive research with quantitative data in psychology. I or II; 1 unit. Prerequisite: Psychology 135, or an equivalent course in statistical methods; consent of instructor. Cohen.

409. Problems in Motivation. I or II; 1 unit. Young.

412. Advanced Child Psychology. I or II; 1 unit. Prerequisite: Consent of instructor. Wischner.

415. Experimental Psychology. A study of experimentation in the various fields of psychology, with emphasis on types of problems investigated, apparatus used, and methods of experimental design. I, II; 1 unit. Prerequisite: Fourteen hours of psychology, including a laboratory course in experimental psychology and a course in elementary statistics. O'Kelly, Osgood.

418. Experimental Psychology of Learning. A study of experimental investigations of the learning process, with emphasis on types of problems studied, methods of procedure, and theoretical significance of results. I, II; 1 unit. Prerequisite: Fourteen hours of psychology, including a laboratory course in experimental psychology. Irion, Osgood.

426. Experimental Psychology of the Communication Process. Same as Communications 426. A critical survey of methods and theories in the psychological study of the communication process, with the emphasis upon the

development of symbolic behavior, experimental semantics, and frequency studies; application will be made to various problems in social science. II; 1 unit. Prerequisite: One year of graduate study; consent of instructor. OSGOOD.

428. SYSTEMATIC PSYCHOLOGY. A critical analysis and comparison of modern and contemporary psychological systems. I, II; 1 unit. WOODROW.

430. CONTEMPORARY BEHAVIOR THEORY. An introduction to modern attempts to formulate scientific theories of behavior. Special emphasis on theories concerning the learning process, including the work of Hull, Tolman, and Guthrie. I or II; 1 unit. GRICE.

434. TEST CONSTRUCTION. A systematic development and critical consideration of the theories, methods, and techniques in test construction. I or II; 1 unit. Prerequisite: A course in statistics. MCQUITTY.

436. PERSONALITY. A survey of experimental and theoretical studies of human personality, including its development, modification, and relation to society. I, II; 1 unit. Prerequisite: Psychology 150, 286, and 338, or their equivalent. CATTELL, STAGNER.

438. INTELLIGENCE. The nature, causes, and consequences of individual differences in intelligence. I or II; 1 unit. Prerequisite: A course in statistics, Psychology 286 or 465; consent of instructor. WOODROW.

441. MEASUREMENT OF OPINION AND ATTITUDE. Same as Communications 441 and Journalism 441. Theory and practice in measurement of opinion and attitude formation and change. Attitude scales; factors affecting morale; interpretation of results from social and psychological characteristics of the population; intensity of attitudes; relations among attitudes and opinions. I or II; 1 unit. Prerequisite: Psychology 100; a course in statistics; a course in sociology, social psychology, advertising, or market research. HARRELL.

446. THE PSYCHODYNAMICS OF SOCIAL GROUPS. An advanced course in social psychology for graduates which deals largely with the dynamics of group life. I; 1 unit. Prerequisite: A course in abnormal psychology or mental adjustment; a course in statistics; consent of instructor. Offered in 1950-1951 and in alternate years. CATTELL.

448. HISTORY OF PSYCHOLOGY. I or II; 1 unit. Prerequisite: Eighteen hours of psychology. GRICE.

451. PERSONNEL PSYCHOLOGY IN BUSINESS AND INDUSTRY. The application of psychological principles and procedures to personnel methods in industry and business. I, II; 1 unit. Prerequisite: Psychology 290; consent of instructor. HARRELL, MCQUITTY.

455. PRACTICE IN INDUSTRIAL PSYCHOLOGY. Intensive practice on projects in the Office of Nonacademic Personnel. I, II; 1 unit. Prerequisite: A course in industrial psychology and in tests and measurements; consent of instructor. HANSEN, HARRELL.

457. PSYCHOGENICS OF INDUSTRIAL CONFLICT. Same as Labor and Industrial Relations 457. Offers an opportunity for advanced study, through readings in current literature, lectures, field projects, and visiting speakers, of the psychological origins of industrial conflict. Theoretical analysis of the perceptions, emotions, motives, and frames of reference of managerial executives, workers, and union officials will be supplemented by visits to industrial enterprises and union headquarters. Each student will be required

to do an intensive library and field study of some specific problem in labor-management relations. II; 1 unit. Prerequisite: Psychology 357; consent of instructor. STAGNER.

459. HUMAN FACTORS IN EQUIPMENT DESIGN. Experimental psychology applied to the design of machines and equipment for human use, with special reference to aviation and aircraft. I or II; 1 unit. Prerequisite: Psychology 130 and 135, or their equivalent; consent of instructor. WILLIAMS.

461. BEHAVIOR DISORDERS. Psychological study of the behavior disorders, with special emphasis on the analysis of the individual case as encountered in the behavior clinic. The course also provides a study of the biosocial approach to the behavior disorders and a review of recent experimental-clinical literature pertaining to the problem. I, II; 1 unit. Prerequisite: Psychology 135, 286, 338, or their equivalent; consent of instructor.

465. PRACTICE IN PSYCHOLOGICAL TESTING. Instruction and practice in the administration and interpretation of individual tests of general intelligence, special abilities, and achievement. I, II; 1 unit. Prerequisite: Psychology 286, or equivalent. POMEROY.

468. PRACTICE IN PROJECTIVE TECHNIQUES. Designed to give practical training in the administration of clinical techniques commonly used in psychological diagnosis. Emphasis on the Rohrschach test. I, II; 1 unit. Prerequisite: Psychology 465, or equivalent; consent of instructor. POMEROY.

471. PSYCHOLOGICAL COUNSELING AND PSYCHOTHERAPY. Critical examination of the methods and theories of psychological counseling, psychotherapies, and remedial treatment in the psychological clinic. I; 1 unit. Prerequisite: Psychology 216, 286, and 465. COLLIER, HELLMER.

472. PRACTICE IN PSYCHOLOGICAL COUNSELING AND PSYCHOTHERAPY. A practicum course in methods of interviewing, counseling, and psychotherapy under supervision. Open only to students who have completed Psychology 471. II; 1 unit. Prerequisite: Psychology 216, 286, 465, and 471. COLLIER, HELLMER.

474. THEORY AND RESEARCH IN PSYCHOTHERAPY. Study and analyses of clinical recordings in the light of contemporary theory of neurosis, with special reference to research problems and methods. I or II; 1 unit. Prerequisite: Psychology 472, or equivalent, or concurrent registration therein. MOWRER.

475. THEORY AND RESEARCH IN PSYCHOTHERAPY. This course is a continuation of Psychology 474, but may be elected independently. II; 1 unit. Prerequisite: Psychology 472, or equivalent, or concurrent registration therein. MOWRER.

476. PRACTICE IN PSYCHOLOGICAL COUNSELING AND THERAPY WITH COLLEGE STUDENTS. The psychological principles and techniques of student personnel work, with special reference to counseling procedures utilized at the college level. Supervised observation and practice in the Student Counseling Bureau. I, II; 1 unit. Prerequisite: Completion of course requirements for master's degree in psychology or education; sixteen hours of psychology; Psychology 383, or equivalent; fitness for referred student counseling as determined by the instructor. GILBERT.

478. NEUROPHYSIOLOGY FOR CLINICAL PSYCHOLOGISTS. A clinical approach to the study of the anatomy and physiology of the nervous system together with descriptions of typical malfunctions; designed primarily for the student in clinical psychology who expects to work with institutional cases. II; 1 unit. Prerequisite: Graduate standing in psychology; appointment in the Cooperative Veteran's Administration training program for clinical psychologists; consent of instructor.

482. Practice in Clinical Psychology. Practice in clinical case study, including personal and social histories; training in the interpretation of reports of medical examiners, teachers, social agencies, etc.; participation in the regular work of psychological clinic; training in diagnostic testing, diagnostic and therapeutic interviewing, and preparation of clinic reports. I, II; 1 to 2 units. Prerequisite: Psychology 465 and 468; credit or registration in Psychology 471. This course is required in second-year graduate training in clinical psychology. Collier.

491. Research and Thesis. Experimental investigation. I; ½ to 4 units. Cattell, Cohen, Collier, Grice, Harrell, Hellmer, Higginson, Irion, Lanier, McQuitty, Mowrer, O'Kelly, Osgood, Stagner, Williams, Woodrow, Young.

492. Research and Thesis. Experimental investigation. II; ½ to 4 units. Cattell, Cohen, Collier, Grice, Harrell, Hellmer, Higginson, Irion, Lanier, McQuitty, Mowrer, O'Kelly, Osgood, Stagner, Williams, Woodrow, Young.

493. Research Seminar. Discussion of current topics in their historical setting, with special emphasis on research problems. I; 1 unit. Prerequisite: Fourteen hours of psychology; consent of instructor. Staff.

494. Research Seminar. Discussion of current topics in their historical setting, with special emphasis on research problems. II; 1 unit. Prerequisite: Fourteen hours of psychology; consent of instructor. Staff.

Courses for Graduates and Advanced Undergraduates

338. Abnormal Psychology. An introduction for preprofessional students to the psychological aspects of the behavior disorders, including study of the insanities, psychoneuroses, mental deficiencies, and other conditions. I, II; ½ unit. Prerequisite: Six hours of psychology; junior standing except for those in the premedical curriculum who may take the course as second semester sophomores with four hours of psychology. Irion.

345. Comparative Psychology. Animal behavior with particular reference to the behavior of vertebrates. I or II; ½ unit. Prerequisite: Six hours credit in psychology, or Psychology 100, 103, or 106, and one course in zoology. McAllister.

353. The Psychology of International Relations. Psychological insights into the problems of international relations: nationalism, war and peace, international conferences, etc. Individual differences due to nationality differences and the problems raised by international contacts. II; ½ unit. Prerequisite: Psychology 100 and any one of the following: Psychology 150, Psychology 155, Sociology 110, Sociology 212, or Anthropology 260; and, in addition, three hours of advanced courses in the International Affairs Curriculum. Foreign students by consent of instructor. Grace.

357. Psychology of Industrial Conflict. Same as Labor and Industrial Relations 357. Presents an analysis, in terms of the behavior of individuals, of the causes and possible solutions of industrial conflict. Motives, emotions, attitudes, and ways of perceiving situations are considered in relation to the actions of industrial executives, factory workers, and union leaders. Results of factory observation, public opinion polls, laboratory experimentation, and psychoanalysis are integrated to provide a systematic interpretation of the problem, and to evaluate proposed actions toward a solution. I or II; ½ to 1 unit. Prerequisite: Psychology 100, or equivalent, and one of the following: Psychology 145, Economics 240, or Sociology 318. Stagner.

360. Psychology of Exceptional Children. A survey from the psychological viewpoint of the various types of exceptional children. Emphasis on case studies. I or II; ½ unit. Prerequisite: Psychology 286, or equivalent.

383. Student Counseling. The application of psychological principles and techniques in fitting education processes to the needs, interests, and abilities of the individual college student. I, II; ½ unit. Prerequisite: Psychology 338; a course in statistics. Ewing, Jonietz.

SOCIAL SCIENCES

Through the Division of the Social Sciences (including economics, geography, history, philosophy, political science, psychology, social welfare administration, and sociology), a special program leading to the degree of Master of Arts in the Social Sciences is available to meet the needs of students who wish to study in several related fields within the social sciences rather than to specialize in one department, and the needs of those who contemplate teaching the social sciences. To qualify for this program a student must have a grade-point average of at least 3.5 for that portion of the work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training, and must also be acceptable to the adviser for the program. Students on limited status will be admitted.

The degree of Master of Arts in the Social Sciences requires a major of four units and a minor or double minor totaling four units. No minor may be less than two units. The student's work is directly supervised by an advisory committee, composed of two or three members, one for each field of study forming a major or minor. The representative of the major field is the chairman of the committee. As part of his work in the major field, each student is required to write an essay under the direction of the chairman of the committee and subject to his approval. Work upon this essay may constitute, through registration in research courses, part of the four units of work which are mandatory for the major. At the completion of his studies the student must pass an examination covering the studies and held by the committee as a whole.

The Chairman of the Division of Social Sciences is Professor C. E. Nowell, 309 Lincoln Hall. The general adviser for this degree is Professor F. L. Will, 125 Lincoln Hall.

Candidates for the degree of Master of Arts in the Teaching of Social Studies must earn four units in social studies, three units in education, and one unit in electives. Requirements are (1) social studies selected from not more than three of the following: economics, geography, history (at least two units), philosophy, political science, sociology, four units; (2) two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit; and Education 456, Curriculum Problems and Trends in Specialized Fields of Secondary Education, one unit. The courses in social studies and the electives must be selected with the approval of the adviser. The electives may be in the social studies, in education, or, in exceptional cases, in other fields. The grade-point average required for admission is the same as required by the Division. No limited status students will be admitted to the program.

The adviser for candidates for this degree is Professor F. C. Dietz, 325 Lincoln Hall.

SOCIAL WELFARE ADMINISTRATION

The Division of Social Welfare Administration offers two years of graduate work leading to the degree of Master of Social Work. Much of the work is generic, but there are opportunities for specialization in case work and group work.

The admission requirement, in terms of grade-point average, is at least 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students will not be admitted on limited status.

The Division has established an Admissions Committee which is charged with the responsibility of determining the potentialities of the applicant to acquire and utilize professional education in social work. The Committee's scrutiny of scholastic achievement is directed principally to the applicant's record in the social sciences and preprofessional courses and in those courses which reveal mastery of the English language. A minimum of twenty hours in social science courses is required. Preference is given the student whose background includes such course content as psychology, sociology, economics, political science, social anthropology, history, biology, philosophy, and preprofessional courses such as statistical methods, introduction to social work, child welfare, and introduction to group work. Applicants must have full admission status to be accepted by the Division of Social Welfare Administration.

In addition to scholastic achievement and admission to the Graduate College, the Admissions Committee attempts to determine the applicant's personal suitability for professional education in social work, in terms of age, health, and personal qualities. Preference is given to the applicant between the ages of twenty-one and thirty-five; however, consideration is given to an older applicant who has demonstrated his capacity for social work practice. Admission is granted only to the applicant whose health and physical condition are sufficiently good to permit his undertaking a study program which taxes physical and emotional energy. Admission is granted to the applicant who shows evidence of emotional maturity commensurate with his years and past experience; interest in and a liking for people, and ability to establish harmonious and healthy relationships; demonstrated capacity to make the kind of social adjustment which allows for a variety of social interests; personal integrity as demonstrated by intellectual honesty and a sense of responsibility. Serious lacks in these areas will disqualify the applicant.

Because of the limited number of field work placements in acceptable social agencies, the Division of Social Welfare Administration is compelled to limit its enrollment of students for the degree program to the number of field work placements available.

Application must be made to the Division of Social Welfare Administration in addition to the application for admission to the Graduate College. The special bulletin issued by the Division may be obtained by writing to the Director, Division of Social Welfare Administration, 314 Lincoln Hall.

Scholarships and Assistantships

Several scholarships are provided by social agencies for students who are interested in accepting employment after graduation. Local, state, and national agencies have special scholarships of varying amounts. It is suggested that applicants consult with the Division of Social Welfare Administration regarding the provisions.

A limited number of part-time assistantships are available for second-year students who have demonstrated ability and skills needed in research or other assignments. Application for an assistantship should be made to the Director of the Division.

Graduate Teaching Faculty

Professor and Director of Division: MARIETTA STEVENSON.

Associate Professors: FLORENCE I. HOSCH, RACHEL B. MARKS, FLORENCE L. POOLE, W. P. SIMON.

Assistant Professors: MARGARETTA FRISBEE, E. LINZER, MARJORIE W. MAIN, J. E. MCDONALD, EDITH L. NAGEL, BERNICE PERLMAN.

Lecturers: J. BORUS, HELEN COYLE, J. P. HAM, MARY S. KUNST, VIRGINIA LEHMANN, J. B. RICHMOND.

Courses for Graduates

(For students admitted prior to fall of 1950)

405. FIELD INSTRUCTION IN SOCIAL WORK III. An advanced course with field work placement in a social agency selected with reference to specific aptitudes, choice, or needs of the student. The objective is to provide an opportunity for continued development of skill in practice. An advanced classroom course in social case work or social group work must be taken concurrently. I, II; 1 unit. Prerequisite: Either Social Welfare Administration 401 and 402, or 403 and 404. NAGEL, PERLMAN, SIMON, and agency supervisors.

406. FIELD INSTRUCTION IN SOCIAL WORK IV. The fourth semester in field instruction is aimed toward integrating the total learning of the previous semesters with field work selected to implement the transition from student to agency worker. An advanced classroom course in social case work or social group work must be taken concurrently. I, II; 1 unit. Prerequisite: Social Welfare Administration 405. NAGEL, PERLMAN, SIMON, and agency supervisors.

413. SOCIAL CASE WORK III. Continuation of Social Case Work II, with study focused on the dynamics of family relationships to enable the student to deepen his understanding of the client's emotional and social needs. Case records are used for study and discussion, with emphasis on the generic use of the social case work method of helping the individual within the framework of different agency settings. I; 1 unit. Prerequisite: Social Welfare Administration 411 and 412. POOLE.

414. CASE WORK WITH CHILDREN. Study of case records with emphasis on principles and methods utilized in working with children. Consideration is given to their treatment through parent-child relationships, child placement, the selection and use of foster homes and institutions. II; 1 unit. POOLE.

433. SOCIAL GROUP WORK III. An advanced course in group work practice focused on work with groups in various settings such as youth agencies, hospitals, community centers, and clinics. Specific attention is given to problems of departmental program planning, study, and research. I or II; 1 unit. Prerequisite: Social Welfare Administration 431 and 432. SIMON.

434. SOCIAL GROUP WORK IV. A seminar course. Consideration of principles of social group work methods with specific application to administrative processes in agencies using group work method. Examination of structure and function of agencies as related to broad social needs. Principles of agency-wide program development. Problems of specialized application of group work method in medical, psychiatric, and other fields. Discussion based on material drawn from students' field experience and presented in class. I or II; 1 unit. Prerequisite: Social Welfare Administration 433. SIMON.

439. Supervision in Group Work. A course dealing with supervisory and program administrative responsibilities. Emphasis is on educative methods of supervision of staff workers and volunteers. Records and problems are used as a basis of discussion. I; 1 unit. Simon.

441. Community Organization. An examination of the problem of identifying social needs in the community and of developing programs to meet them; analysis of the function of the community chest, council of social agencies, social service exchange, social settlement, etc.; the function of the professional worker in the process of social planning. I, II; 1 unit. Hosch.

455. Medical Social Information. A survey of the need for health services. The organization and functions of existing medical care programs, public and private. Present theories and trends in respect to the social and economic aspects of public health. I or II; 1 unit. Hosch.

456. Advanced Social Psychiatry. This course is designed to further meet the needs of social workers for a background knowledge of psychopathology and psychotherapy. It includes a further consideration of mental and nervous disorders, maladjustments, and faulty patterns of personal and social integration, with emphasis on psychodynamic factors in their origin and psychotherapeutic elements in their management. I, II; 1 unit. Coyle.

464. The Law and Social Work. The principles of law with which the social worker should become familiar; those defects in judicial administration that especially affect persons with low incomes; the sources of preventable delay and cost; the establishment of small claims and conciliation courts; the growth of legal aid societies and their work. I, II; 1 unit. Lehmann.

466. Social Insurance. Social insurance legislation and administration in Europe and the United States, with special reference to the experience in this country. Deals with the problems arising under the different titles of the Federal Social Security Act, with reference to current problems. I; 1 unit. Borus.

471. Public Welfare Organization and Administration. Development of the public welfare services, with special reference to intergovernmental relationships; present administrative problems of federal, state, and local agencies with relation to organization, staffing, financing, directing, supervision, etc. II; 1 unit. Stevenson.

472. Seminar in Public Welfare Administration. Current problems in public welfare organization and administration will be analyzed. I, II; 1 unit. Prerequisite: Social Welfare Administration 463 and 471. Stevenson.

476. Administration in Social Agencies. Analysis of the processes of administration as they apply in specific types of social agencies. Consideration of the role of governing bodies, executives, and staff in policy making and program development. Problems in management, personnel, financing, planning, control, and public information. II; 1 unit. Hosch.

491. Research. Preparation of thesis. Required of each candidate for a degree. I, II; 1 to 2 units. Marks.

492. Research. Preparation of thesis. Required of each candidate for a degree. I, II; 1 to 2 units. Marks.

(For students admitted in the fall of 1950)

421. Social Work Method I. A course of study in the principles of social work theory and their application in practice. It is designed to help the student acquire and develop mastery in the practice of social work and it relates

the use of research methodology to this practice. Instruction is carried on in the class room and through tutorial conferences related to field practice in selected social agencies. I; 2 to 4 units. General Theory: NAGEL, SIMON. Field Instruction: LINZER, MAIN, McDONALD, POOLE, and agency supervisors.

422. SOCIAL WORK METHOD II. Continuation of Social Work Method I. This course is designed to deepen the student's knowledge and skill in their particular area of instruction: casework or group work. II; 2 to 4 units. Prerequisite: Social Welfare Administration 421. General Theory: NAGEL, SIMON. Field Instruction: LINZER, MAIN, McDONALD, POOLE, and agency supervisors.

423. SOCIAL WORK METHOD III. Continuation of Social Work Method II. In addition this course is designed to include the processes of administration and supervision. I; 2 to 4 units. Prerequisite: Social Welfare Administration 422. General Theory: POOLE, SIMON. Field Instruction: LINZER, MAIN, McDONALD, PERLMAN, and agency supervisors.

424. SOCIAL WORK METHOD IV. A seminar course. Continuation of Social Work Method III. In addition there will be an examination of practice in the various settings in which social work is practiced. Emphasis will be given to assisting the student in the transition to professional worker. II; 2 to 4 units. Prerequisite: Social Welfare Administration 423. General Theory: SIMON. Field Instruction: LINZER, MAIN, McDONALD, PERLMAN, POOLE, and agency supervisors.

451. DYNAMICS OF HUMAN DEVELOPMENT I. This course is designed to enable the student to understand the meaning of behavior in individuals and groups. It is based upon factual knowledge, viewing the growth and development of the individual as a whole, and gives consideration to the inter-relatedness of physical, intellectual, emotional, and social changes which the individual undergoes as he moves through life, constantly acting upon and being acted upon by the environment. I; 1 to 2 units. HOSCH, KUNST, RICHMOND.

452. DYNAMICS OF HUMAN DEVELOPMENT II. Continuation of Social Welfare Administration 451 with added emphasis on the dynamics of the social process. II; 1 to 2 units. Prerequisite: Social Welfare Administration 451. HOSCH, KUNST, RICHMOND.

453. DYNAMICS OF HUMAN DEVELOPMENT III. A continuation of Social Welfare Administration 452 with emphasis on the adult. Special consideration is given to the cultural factors in social work practice. I; 1 to 2 units. Prerequisite: Social Welfare Administration 452. COYLE, HOSCH, KUNST, RICHMOND.

454. DYNAMICS OF HUMAN DEVELOPMENT IV. A continuation of Social Welfare Administration 453 with some emphasis on the aging process and advanced psychopathology for the social worker. II; 1 to 2 units. Prerequisite: Social Welfare Administration 453. COYLE, HOSCH, KUNST, RICHMOND.

481. SOCIAL WELFARE ORGANIZATION I. A course covering the current services and organization for common welfare needs with analysis of the forces giving rise to their development and evolution. Current programs and trends; historical background; socio-economic factors; legal implications will be considered. I; 1 to 2 units. HOSCH, LEHMANN, STEVENSON.

482. SOCIAL WELFARE ORGANIZATION II. A continuation of Social Welfare Organization I with emphasis on factors of income maintenance, social insurance, public assistance, child welfare, health and medical care. II; 1 to 2 units. Prerequisite: Social Welfare Administration 481. BORUS, HOSCH, STEVENSON.

483. Social Welfare Organization III. A continuation of Social Welfare Organization II with emphasis on foreign and international developments, coordinating and planning services, social legislation, public and private financing of social services. I; 1 to 2 units. Prerequisite: Social Welfare Administration 482.

484. Social Welfare Organization IV. A continuation of Social Welfare Organization III with emphasis on the administrative structure of social agencies, special administrative problems in various settings and current developments in social welfare. II; 1 to 2 units. Prerequisite: Social Welfare Administration 483.

491. Research. Preparation of thesis. Required of each candidate for a degree. I, II; 1 unit. Marks.

492. Research. Preparation of thesis. Required of each candidate for a degree. I, II; 1 unit. Marks.

Courses for Graduates and Advanced Undergraduates

311. Introduction to Social Case Work. This course for employed workers deals with the behavior and attitudes expressed by persons asking for assistance, the feelings thus engendered, and the effects of all of these on the contacts of social case workers with individuals and families. Attention will be given to case records selected from social case work practice in public assistance and other community agencies. I, II; ½ unit. Nagel.

SOCIOLOGY AND ANTHROPOLOGY

The Department of Sociology and Anthropology offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy. Graduate students electing sociology as their major must have had at least nine hours of undergraduate work in sociology and fifteen hours in one or more of the following subjects: anthropology, economics, genetics, history, philosophy, political science, and psychology. The admission requirement, in terms of grade-point average, is at least 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students will be admitted on special status.

Sociology 285 is required of all graduate student majors. Students must fulfill this requirement without graduate credit if they have not done so as undergraduates. A thesis is required of all candidates for the degree of Master of Arts. Those who elect sociology as a minor must have had at least six hours of undergraduate work in sociology.

Assistantships

There are a number of part-time teaching assistantships available for students who have completed work for the degree of Master of Arts. Candidates for assistantships should apply to the Chairman of the Department.

Graduate Teaching Faculty

Professors: J. W. Albig (Chairman of Department), D. E. Lindstrom, D. R. Taft.

Associate Professors: R. Dubin, J. E. Hulett, Jr., O. Lewis, J. C. McGregor, B. F. Timmons.

Assistant Professors: R. Bierstedt, R. Dewey, D. E. Wray.

SOCIOLOGY

Courses for Graduates

400. General Sociology. I or II; 1 unit. Bierstedt.

412. Seminar in Social and Cultural Relations of Personality. I, II; 1 unit. Hulett.

418. Seminar in Human Relations in Industry. Same as Labor and Industrial Relations 418. Individual research in sociological interpretation of industrial organization; the orientation and motivation of the individual in industry and commerce; labor-management relations as group adjustments; the interrelations of industry and the community. I; 1 unit. Prerequisite: Six hours of sociology including Sociology 318, or consent of instructor. Dubin, Wray.

420. Seminar in Education for Marriage and the Family. I or II; 1 unit. Prerequisite: Sociology 220 recommended. Timmons.

422. Theory of Social Groups. Seminar on comparative analysis of various social groups, their origin, composition, structure, functional organization, and dynamic relationships with other groups. I or II; 1 unit. Dubin.

424. Seminar in Penology. I or II; 1 unit. Prerequisite: Sociology 331, or equivalent. Taft.

430. Seminar in Social Effects of Poverty, Their Prevention and Treatment. I or II; 1 unit. Prerequisite: Sociology 230 and undergraduate economics recommended. Timmons.

431. Seminar in Criminology. I or II; 1 unit. Prerequisite: Sociology 331, or equivalent. Taft.

444. Seminar in Public Opinion. Same as Communications 444. I, II; 1 unit. Albig.

447. Sociology of International Conflict. A consideration of materials bearing on cultural and sociological aspects of the causation of modern war together with their relationship to political, psychological, and economic aspects. I; 1 unit. Taft.

471. Regionalism and Social Morphology. Specific analysis of the problems which apply to regional bases and not to the conventional political boundaries. I or II; 1 unit.

476. Urban Communities and Urbanization. Intensive study of special aspects of the urbanization process as it affects the life of communities in this and in other countries. I or II; 1 unit. Dewey.

477. Rural Community Organization. Same as Agricultural Economics 477. A study of rural community structure, functions, and processes, to give the student a concrete picture of how rural communities operate, and the forces which cause change in the group life of the people living in a rural community. I or II; 1 unit. Lindstrom.

480. Sociological Theory and Method. Seminar on the methods of scientific research by which original contributions to sociological theory are made. I or II; 1 unit.

481. Seminar in Culture Integration. I or II; 1 unit.

482. Recent Developments in Sociology. II; 1 unit. Albig.

488. European Sociological Theory. Selected problems of contemporary sociological thought, e.g., the question of objectivity (sociology of knowledge); what constitutes sociology as a special science; the problem of social dynamics. I or II; 1 unit. Prerequisite: Sociology 100.

491. Research and Thesis. Preparation of theses. I; ½ to 3 units. Staff.

492. Research and Thesis. Preparation of theses. II; ½ to 3 units. Staff.

Courses for Graduates and Advanced Undergraduates

315. Sociology of Education. Same as Education 315. Objective comparative study of education as a social process in various cultures and historical periods, with main emphasis on present education in countries which share Western civilization. I or II; ½ unit. Prerequisite: Sociology 100. Shideler.

318. Human Relations in Industry. Same as Labor and Industrial Relations 318. Sociology of industry and problems of personal adjustment. The emergence of modern industrial and labor organizations and their impact upon community life. I, II; ½ to 1 unit. Prerequisite: Psychology 100, Sociology 100, or consent of instructor. Chandler, Dubin, Wray.

320. Social Roles. Comparative study of organized participation of individuals in social life and culture. I or II; ½ unit. Prerequisite: Sociology 100.

324. Penology. Probation; parole; methods of institutional treatment. I or II; ½ unit. Prerequisite: Sociology 331. Taft.

327. National Culture Societies. A comparative sociological survey of the formation, social organization, and interaction of modern nationalities as cultural groups. I or II; ½ unit.

331. Criminology. Crime from the point of view of personality and social situations. I, II; ½ unit. Prerequisite: Sociology 100; open to prelegal juniors by consent of instructor. Taft.

332. Prevention and Treatment of Juvenile Delinquency. I or II; ½ unit. Prerequisite: Sociology 100 or 331. Esselstyn, Taft.

344. Public Opinion. Opinion changes and control; propaganda; interest groups and opinion; critical review of methods of measurement. I, II; ½ unit. Prerequisite: Sociology 100. Albig.

347. Sociology of International Conflict. War as a social process. Conflict of national cultures, population pressures, race relations, immigration policies, restrictions on communication, and other elements in the international conflict process. Occupation policies in Germany and Japan. Implications of social science for changes in the process. II; ½ unit. Prerequisite: Sociology 327 recommended. Taft.

375. Sociology of the Community. Nature, structure, and functions of the community. Types of communities and examples of some better community studies. The relation of the community to the larger social organization. I or II; ½ unit. Prerequisite: Sociology 100; eleven hours of sociology. Timmons.

378. Acculturation in Modern Society. II; ½ unit. Prerequisite: Five hours of sociology.

385. Methods of Sociological Research. I, II; ½ unit. Prerequisite: Eight hours of sociology. Bierstedt.

ANTHROPOLOGY

Courses for Graduates and Advanced Undergraduates

353. Southwestern Archaeology. This course is a detailed study of one archaeological unit in the United States. It covers the three broad cultures with regional variations considered chronologically and stressing interrelationships of the various cultures. I or II; ½ unit. Prerequisite: Anthropology 107. McGregor.

354. Field Techniques. Participation in archaeological excavation; techniques, methods, and procedures discussed and practiced in actual working conditions. S; 1 unit. Prerequisite: Consent of instructor. McGregor.

355. Laboratory Techniques and Problems in Archaeology. Laboratory work in the field, studying, evaluating, and writing final report on preceding field work. S; 1 unit. Prerequisite: Consent of instructor. McGregor.

356. Physical Anthropology. The aims and methods of physical anthropology; both osteology and somatology, with emphasis on the human skeleton. II; 1 unit. Prerequisite: Anthropology 107, or Sociology 104, or a course in anatomy or comparative anatomy, or an introductory course in zoology, or consent of instructor. McGregor.

363. Religion in Primitive Society. An introduction to the study of magic and religion in non-literate societies; the course will consider theories of the origin and function of magic and religion and an analysis of magic and religion in representative primitive societies. II; 1 unit. Prerequisite: Anthropology 107 or Sociology 104. Lewis.

SPANISH AND ITALIAN

(Including Portuguese)

The Department of Spanish and Italian offers courses leading to the degrees of Master of Arts and Doctor of Philosophy in Spanish and Italian, language and literature, to a minor in Portuguese, and a Master of Arts in the Teaching of Spanish.

The departmental admission requirement is a grade-point average of at least 4.0 for that portion of the work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. However, the Department reserves the right to admit students on limited status. Prerequisite for a graduate major is an undergraduate major in one Romance language or Latin, and consent of the departmental adviser. Prerequisite for a minor is consent of the departmental adviser.

Assistantships

A limited number of teaching assistantships is available. Application may be made to the Head of the Department.

Graduate Teaching Faculty

Professors: J. Van Horne (Head of Department), A. Hamilton, H. R. Kahane.

Associate Professor: R. P. Oliver.

Assistant Professors: J. H. D. Allen, J. S. Flores, Angelina R. Pietrangeli.

Instructor: C. Zardoya (Visiting).

SPANISH

Students doing graduate work for an advanced degree in Spanish must acquire a practical command of the language. Some knowledge of Italian or Portuguese is recommended. A considerable amount of parallel training in one or more other languages or literatures such as English, French, German, Greek, or Latin, is indispensable. In any case, some Latin is required of candidates for the Doctor of Philosophy degree, a reading knowledge of simple Latin prose being the desirable minimum.

Candidates for the degree of Master of Arts in the Teaching of Spanish must earn four units in Spanish, two units in education, and two units in electives. Requirements are Spanish (middle group courses, one to two units, and graduate courses, two to three units), four units; education, two units, including two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit. The courses in Spanish and the electives must be selected with the approval of the adviser. The electives may be in Spanish, in education, or, in exceptional cases, in other fields. The grade-point average required for admission is the same as required by the Department. No limited status students will be admitted to this program. The adviser for candidates for this degree is Professor Arthur Hamilton, 216 Lincoln Hall.

Courses for Graduates

411. Spanish Literature in the Middle Ages. I; 1 unit. Offered in 1950-1951 and in alternate years. Van Horne.

412. Spanish Literature in the Middle Ages. II; 1 unit. Offered in 1950-1951 and in alternate years. Van Horne.

413. Contemporary Literature. Twentieth century writings in Spain and Spanish America. I; 1 unit. Van Horne.

414. Contemporary Literature. Twentieth century writings in Spain and Spanish America. II; 1 unit. Van Horne.

415. Spanish Literature in the Sixteenth Century. I; 1 unit. Offered in 1950-1951 and in alternate years. Van Horne.

416. Spanish Literature in the Sixteenth Century. II; 1 unit. Offered in 1950-1951 and in alternate years. Van Horne.

417. Seventeenth Century Literature. I; 1 unit. Offered in 1951-1952 and in alternate years. Oliver.

418. Seventeenth Century Literature. II; 1 unit. Offered in 1951-1952 and in alternate years. Oliver.

419. Spanish Literature of the Golden Age. Special problems in the literature of the Golden Age. S; 1 unit. Kahane.

421. Modern Spanish and Spanish American Novel. I; 1 unit. Offered in 1951-1952 and in alternate years.

422. Modern Spanish and Spanish American Novel. II; 1 unit. Offered in 1951-1952 and in alternate years.

431. Latin American Literature. I; 1 unit. Offered in 1950-1951 and in alternate years. Allen.

432. Latin American Literature. II; 1 unit. Offered in 1950-1951 and in alternate years. Allen.

451. Seminar in Spanish Linguistics. Research work in Castilian and Latin American linguistics. I; 1 unit. Offered in 1950-1951 and in alternate years. Kahane.

452. Seminar in Spanish Linguistics. Research work in Castilian and Latin American linguistics. II; 1 unit. Offered in 1950-1951 and in alternate years. Kahane.

453. Old Spanish. I; 1 unit. Offered in 1951-1952 and in alternate years. Kahane.

454. Old Spanish. II; 1 unit. Offered in 1951-1952 and in alternate years. Kahane.

491. Seminar (Thesis Course). Research work in special topics. I; 1 to 4 units. Hamilton, Kahane, Oliver, Van Horne.

492. Seminar (Thesis Course). Research work in special topics. II; 1 to 4 units. Hamilton, Kahane, Oliver, Van Horne.

Courses for Graduates and Advanced Undergraduates

301. Survey of Spanish Literature. I; ½ unit. Prerequisite: Spanish 202, or equivalent. Flores.

302. Survey of Spanish Literature. II; ½ unit. Prerequisite: Spanish 202, or equivalent. Flores.

303. Survey of Latin American Literature. I, II; ½ unit. Prerequisite: Spanish 202, or equivalent.

304. Survey of Latin American Literature. I, II; ½ unit. Prerequisite: Spanish 202, or equivalent.

311. Cervantes: Don Quixote. I, II; ½ unit. Prerequisite: Spanish 202, or equivalent. Offered in 1951-1952 and in alternate years.

312. Cervantes: Don Quixote. I, II; ½ unit. Prerequisite: Spanish 202, or equivalent. Offered in 1951-1952 and in alternate years.

313. Classical Spanish Drama. I; ½ unit. Prerequisite: Spanish 202, or equivalent. Offered in 1950-1951 and in alternate years. Oliver.

314. Classical Spanish Drama. II; ½ unit. Prerequisite: Spanish 202, or equivalent. Offered in 1950-1951 and in alternate years. Oliver.

321. Modern Spanish and Spanish American Drama. I; ½ unit. Prerequisite: Spanish 202, or equivalent. Pietrangeli.

322. Modern Spanish and Spanish American Drama. II; ½ unit. Prerequisite: Spanish 202, or equivalent. Pietrangeli.

323. Modern Spanish and Spanish American Novel. Nineteenth and twentieth century novels of Spain. I; ½ unit. Prerequisite: Spanish 202, or equivalent. Hamilton.

324. Modern Spanish and Spanish American Novel. Nineteenth and twentieth

century novels of Spanish America. II; ½ unit. Prerequisite: Spanish 202, or equivalent. HAMILTON.

325. LYRIC POETRY. Spanish and Spanish American lyrics. I; ½ unit. Prerequisite: Spanish 202, or equivalent. Offered in 1950-1951 and in alternate years. ALLEN.

326. LYRIC POETRY. Spanish and Spanish American lyrics. II; ½ unit. Prerequisite: Spanish 325. Offered in 1950-1951 and in alternate years. ALLEN.

331. LA CULTURA HISPÁNICA: ESPAÑA. I; ½ unit. VAN HORNE, ZARDOYA.

332. LA CULTURA HISPÁNICA: AMERICA HISPANA. II; ½ unit. VAN HORNE.

351. PHONETICS. I; ½ unit. Required for teacher-training majors in Spanish. Prerequisite: Spanish 202, or equivalent. FLORES, KAHANE.

352. SYNTAX. II; ½ unit. Required for teacher-training majors in Spanish. Prerequisite: Spanish 202, or equivalent. KAHANE.

ITALIAN

Students doing graduate work for an advanced degree in Italian must acquire a practical command of the language. Some knowledge of Spanish is recommended. A considerable amount of parallel training in one or more other languages or literatures such as English, French, German, Greek, Latin, or Portuguese, is indispensable. In any case, some Latin is required of candidates for the Doctor of Philosophy degree, a reading knowledge of simple Latin prose being the desirable minimum.

Courses for Graduates

411. ITALIAN LITERATURE IN THE MIDDLE AGES: PETRARCH AND BOCCACCIO. I; 1 unit. Offered in 1950-1951 and in alternate years. OLIVER.

412. ITALIAN LITERATURE IN THE MIDDLE AGES: PETRARCH AND BOCCACCIO. II; 1 unit. Offered in 1950-1951 and in alternate years. OLIVER.

415. ITALIAN LITERATURE OF THE RENAISSANCE. I; 1 unit. Offered in 1951-1952 and in alternate years. OLIVER.

416. ITALIAN LITERATURE OF THE RENAISSANCE. II; 1 unit. Offered in 1951-1952 and in alternate years. OLIVER.

451. SEMINAR IN ITALIAN LINGUISTICS. I; 1 unit. KAHANE.

452. SEMINAR IN ITALIAN LINGUISTICS. II; 1 unit. KAHANE.

491. SEMINAR (THESIS COURSE). Research in special topics. I; 1 to 4 units. KAHANE, OLIVER, VAN HORNE.

492. SEMINAR (THESIS COURSE). Research in special topics. II; 1 to 4 units. KAHANE, OLIVER, VAN HORNE.

Courses for Graduates and Advanced Undergraduates

311. DANTE: LA DIVINA COMMEDIA. I; ½ unit. Prerequisite: Italian 101 and 102. Italian 103 and 104 are optional, but desirable. PIETRANGELI.

312. DANTE: LA DIVINA COMMEDIA. Continuation of Italian 311. II; ½ unit. Prerequisite: Italian 101 and 102. Italian 103 and 104 are optional, but desirable. PIETRANGELI.

321. Modern Italian Literature. I; ½ unit. Prerequisite: Italian 101 and 102. Italian 103 and 104 are optional, but desirable. Van Horne.

322. Modern Italian Literature. II; ½ unit. Prerequisite: Italian 101 and 102. Italian 103 and 104 are optional, but desirable. Van Horne.

PORTUGUESE

Courses for Graduates

491. Seminar. Research in special topics. I; 1 to 4 units. Allen, Kahane.

492. Seminar. Research in special topics. II; 1 to 4 units. Allen, Kahane.

Courses for Graduates and Advanced Undergraduates

301. Introduction to Brazilian Literature. Survey of the contemporary Brazilian novel. I; ½ unit. Prerequisite: Portuguese 101 and 102. Portuguese 103 and 104 are optional, but desirable. Allen.

302. Introduction to Portuguese Literature. Survey of the Golden Age of Portuguese. II; ½ unit. Prerequisite: Portuguese 101 and 102. Portuguese 103 and 104 are optional, but desirable. Allen.

SPEECH

The Department of Speech offers the degrees of Master of Arts, Master of Science, and Doctor of Philosophy.

The admission requirement, in terms of grade-point average, is at least 3.5 for that portion of work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students will be admitted on limited status except in the special curricula in the teaching of speech and in speech correction.

For the degree of Master of Arts, students may concentrate in one of these areas: general speech, public address, theater, oral interpretation, speech science, speech and hearing disorders. They may also select a special curriculum in the teaching of speech.

For the degree of Master of Science, students may take a special curriculum in speech correction.

For the degree of Doctor of Philosophy, students may exercise one of three options: rhetoric and public address; the theater; speech science, speech and hearing disorders.

In addition to the general regulations of the Graduate College with respect to entrance, distribution of credits, examinations, and theses, the Department of Speech specifies the following requirements listed below:

Degree of Master of Arts. The entering student should present the equivalent of sixteen hours of undergraduate work in speech. If he does not present sixteen hours of credit in speech, he must make up the deficiency before he can be regarded as a candidate for a graduate degree. His record should include these courses or their equivalents: voice and diction or fundamentals of speech, oral interpretation, an elementary course in phonetics, an elementary course in the theater, and an advanced course in public speaking or discussion.

In consultation with the Head of the Department, the candidate chooses an adviser with whom he should confer about all details of his program.

A normal program of study requires eight graduate units (four each semester)

for graduation. The student with a well-rounded undergraduate education may take all eight units in speech; other students are expected to declare a major in speech (to consist of at least four units) and one or two minors in related fields of study outside the Department. As a rule, a minor will not exceed two units.

Whether or not a thesis is presented depends upon the candidate's educational and professional aims. After consultation with the student, the student's adviser and the Department's Graduate Committee will decide in each case whether a thesis should be submitted as part of the degree requirements. Students who expect to go on to a doctor's degree will as a rule be required to present a thesis.

A final, written examination will be required of all candidates. In some cases an oral examination is also stipulated. The examination covers in part the general field in speech and in part the candidate's area of specialization.

Although no reading knowledge of a foreign language is stipulated for the master's degree, students who expect to do further graduate study should become familiar with the language requirements for the doctor's degree.

Degree of Master of Arts in the Teaching of Speech. Candidates for the Master of Arts degree who are interested in public school teaching should meet the following requirements:

(1) In the area of rhetoric and public address:
- (a) Speech, three units, including Speech 322 and 423, and one and one-half units chosen from 311, 312, and 321.
- (b) Education, two units, including two of the following courses: Education 301, Philosophy of Education, Education 302, History of American Education, Education 303, Comparative Education, Education 304, Social Foundations of Education, one unit; and Education 311, Psychology of Learning for Teachers, and Education 312, Mental Hygiene and the School, one unit.
- (c) Electives, three units, one of which must be in speech.

(2) In the area of the theater:
- (a) Speech, four units, including Speech 361 or 362 or 366, 352, 451, 452.
- (b) Education, two units, including Education 400, Philosophy of Education, or Education 302, History of American Education; and Education 409, Advanced Educational Psychology.
- (c) Electives, two units.

The adviser for candidates for this degree is Professor K. A. Windesheim, 336 Illini Hall.

Degree of Master of Science in Speech Correction. This program is designed for teachers who have completed a Bachelor of Science in Speech Correction at the University of Illinois or its equivalent at a recognized college or university, and who desire to obtain an advanced degree in speech correction.

Prerequisite for admission: The four-year curriculum preparatory to speech correction or its equivalent. Students who have not met all of the requirements of a four-year undergraduate curriculum but who desire to take the fifth year of work for a master's degree may register on approval of the adviser, the Coordinator of Teacher Education, and the Dean of the Graduate College.

Requirements:

(1) Four units of speech selected from the following: Speech 383, 475, 476, 483, 486, 488, 489, 493, 494.

(2) Two units of education, one unit from the following four courses: 301, Philosophy of Education, 302, History of American Education, 303, Comparative Education, 304, Social Foundation of Education; and one unit from the following two courses: 311, Psychology of Learning for Teachers, and 312, Mental Hygiene and the School.

(3) Two units of electives. These may be in speech, in education, or, in exceptional cases, in other fields.

The adviser for candidates for this degree is Professor Severina E. Nelson, Speech Clinic, 601 East John Street, Champaign, Illinois.

Degree of Doctor of Philosophy. Students will be accepted as candidates for the doctor's degree who present either a well-rounded undergraduate education with at least sixteen hours of credit in speech or who hold a master's degree from an accredited institution. The doctoral candidate, like the master's candidate, plans his program in consultation with a departmental adviser.

For the student not holding an advanced degree, twenty-four graduate units are required; for the student who holds an advanced degree, sixteen graduate units must be completed. Although the majority of the units are taken within the Department, each candidate must choose at least one minor subject outside the Department to consist of not less than four units. The candidate may choose two minor subjects, and in that case the second minor consists of not less than two units. If two minors are selected one must be closely related to the student's area of emphasis. With the approval of the adviser and the Dean of the Graduate College the second minor may represent a division of the major field of study.

All candidates for the doctor's degree are required to present a thesis which will count for no more than eight graduate units.

At the end of the second year of graduate study, the candidate must pass a preliminary examination. This examination is written; it covers the student's area of specialization and the areas of knowledge represented by the candidate's graduate program. The final examination, after completion of the thesis, is oral and is for the most part restricted to the research represented by the thesis.

A reading knowledge of two foreign languages, usually French and German, is required of all candidates. The examination in one of the languages must have been satisfactorily passed before a candidate starts on his second year of study. If relevant to the student's graduate program, Latin or Greek may be substituted for French or German.

Graduate Teaching Faculty

Professors: K. R. Wallace (Head of Department), G. Fairbanks, B. Hewitt, Severina E. Nelson, W. M. Parrish.

Associate Professors: E. T. Curry, J. C. Kelly, R. Murphy, W. Swanson.

Assistant Professors: O. A. Dieter, Marie K. Hochmuth, L. S. Hultzén, C. B. Owens, C. H. Shattuck, K. A. Windesheim, G. J. Wischner.

Courses for Graduates

411. Greek Rhetoric and Oratory, 500 to 300 B.C. Study of rhetorical theories and selected speeches available in English, and correlation of theory and practice. Early development of the art of rhetoric; relation of rhetorical theories to practice as exemplified in selected speeches. I; 1 unit. Hultzén.

412. Roman Rhetoric and Oratory. Study of Roman rhetorical theory and practice from Hermagoras to Quintillian (ca. 100 B.C. to 200 A.D.). II; 1 unit. Dieter.

423. The Rhetoric of Aristotle. Study of the rhetoric in relation to other works of Aristotle. I; 1 unit. Parrish.

424. Medieval and Renaissance Rhetoric and Oratory. Study of rhetorical theory and practice in medieval and Renaissance times. II; 1 unit. Dieter.

436. Seminar in Public Discussion. Investigation of special problems in public discussion. II; 1 unit. Prerequisite: Speech 213. Murphy.

438. Seminar in Rhetorical Theory. Study of special topics in the history of rhetorical theory. II; 1 unit. Prerequisite: At least one graduate course in rhetoric and oratory. Wallace.

441. Principles and Theories of Oral Interpretation. Historical survey of British and American theories of interpretation. I; 1 unit. Parrish.

442. Seminar in Oral Interpretation. Investigation of basic problems in the history, nature, and function of oral interpretation. II; 1 unit. Prerequisite: Speech 441; consent of instructor. Parrish.

451. Problems in Play Directing in the School Theater. Study of the audience, play selection, the actor's abilities and needs, try-outs and casting, conduct of rehearsals and methods of directing, the dramatic club, contests and festivals. I; 1 unit. Swanson.

452. Problems in Play Production in the School Theater. Study of the school auditoria and stages, stage machinery and equipment and their use, lighting facilities and their use, organization of backstage crews, scene shifting and stage management, production problems of special types of plays. II; 1 unit. Swanson.

465. Seminar in Theater Art. Studies in the aesthetics of the theater. I; 1 to 2 units. Hewitt.

468. Seminar in Theater History. Studies in the history of the theater. II; 1 to 2 units. Hewitt.

471. Electroacoustics of Speech. The application of acoustical and electrical principles to the analysis of speech. Lectures, demonstrations, and laboratory work. I, II; 1 unit. Prerequisite: Speech 375 and 376. Curry.

473. Seminar in Phonetics. Advanced study in phonetic theory, noninstrumental phonetics, linguistic geography. I or II; 1 unit. Prerequisite: Consent of instructor. Hultzén.

475. Experimental Phonetics. Principles of experimental investigation of the physiological aspects of speech and hearing. Survey of the theoretical and experimental literature. Demonstration and experimental work in the speech laboratory. I; 1 unit. Prerequisite: Speech 376. Fairbanks.

476. Experimental Phonetics. Principles of experimental investigation of the acoustical and psychophysical aspects of speech and hearing. Survey of the theoretical and experimental literature. Demonstration and experimental work in the speech laboratory. II; 1 unit. Prerequisite: Speech 475. Fairbanks.

477. Measurement of Speech I. Principles and methods of measuring speech action. Special action recorders and transducers; techniques of analysis; problems of experimental design. Laboratory experimentation. I; 1 unit. Prerequisite: Consent of instructor; credit or registration in Speech 475. Fairbanks.

478. Measurement of Speech II. Principles and methods of measuring the acoustical phenomena of speech. Oscillographic measurement of vocal variables; special instruments and media for automatic graphic recording; analysis of data; problems of experimental design. Laboratory experimentation. II; 1 unit. Prerequisite: Consent of instructor; credit or registration in Speech 476. Fairbanks.

479. Seminar in Experimental Phonetics. Advanced consideration of experimental research in the physiological, acoustical, and psychophysical aspects of speech and hearing. Extensive survey of current literature. S; 1 unit. Prerequisite: Speech 475 and 476, or consent of instructor. Fairbanks.

481. Seminar in Voice and Articulation Disorders. Advanced study of voice and articulation disorders. Survey of research and theory. Principles of therapy. I or II; 1 unit. Prerequisite: Consent of instructor. Kelly.

483. Seminar in Psychology of Speech Disorders. Advanced theoretical study of psychological disorders of speech such as stuttering, delayed speech, and hysterical conditions; survey of current theory and research. I or II; 1 unit. Prerequisite: Consent of instructor. Wischner.

486. Advanced Clinical Techniques in Speech and Hearing. Practice of advanced clinical therapy for speech and hearing disorders; semi-independent management of complex difficult cases; participation in examination and analysis. I, II; 1 to 4 units. Prerequisite: Consent of instructor. Curry, Nelson, Taylor, Wischner.

488. Diagnosis of Speech Disorders. Study of diagnostic procedures used in analysis of symptoms involved in speech disorders. II; 1 unit. Nelson.

493. Research in Special Topics. I; 1 to 3 units. Curry, Dieter, Fairbanks, Hewitt, Hochmuth, Hultzén, Kelly, Murphy, Nelson, Owens, Parrish, Shattuck, Swanson, Wallace, Windesheim, Wischner.

494. Research in Special Topics. II; 1 to 3 units. Curry, Dieter, Fairbanks, Hewitt, Hochmuth, Hultzén, Kelly, Murphy, Nelson, Owens, Parrish, Shattuck, Swanson, Wallace, Windesheim, Wischner.

Courses for Graduates and Advanced Undergraduates

301. Introduction to Phonetics. Basic principles of phonetic study, including observation and representation of pronunciation; ear training; practice in transcription. I, II; ¼ to 1 unit. Parrish, Hultzén.

311. British Public Address. Study of representative British speakers from the sixteenth century to the present. Lectures, reports, and papers. I; ½ to 1 unit. Prerequisite: Speech 117 or 221. Owens.

312. American Public Address. Study of representative American speeches from the sixteenth century to the present. II; ½ to 1 unit. Prerequisite: Speech 117 or 221. Hochmuth.

321. Modern Rhetorical Theory, 1700 to 1890. A consideration of the significant movements in the development of rhetorical theory in England, France, and America from 1700 to 1890. I; ½ to 1 unit. Hochmuth.

322. Modern Rhetorical Theory, 1890 to the Present. A consideration of the significant movements in the development of rhetorical theory in England, France, and America from 1890 to the present. II; ½ to 1 unit. Hochmuth.

342. Advanced Interpretation. Oral interpretation of poetry. II; ¼ to 1 unit. Speech 141. Parrish.

352. Theories of Play Production. Origins and development of modern theatrical production: a critical examination of contemporary ideas and practices in theater architecture, acting, directing, and staging. II; ½ to 1 unit. Hewitt.

361. History of the European Theater to the Renaissance. The theater and the theater arts of ancient and of medieval Europe. I; ¼ to 1 unit. Shattuck.

362. History of the European Theater from the Renaissance to 1900. The European theater and the theater arts from 1576 to 1900, with special reference to the English theater. II; ¼ to 1 unit. Shattuck.

363. Advanced Playwriting. Application of principles of dramatic form and structure to the more complex problems of playwriting. Practice in writing the full-length play. I, II; ½ to 1 unit. Prerequisite: Speech 263; consent of instructor.

366. Development of the American Theater. The development of the theater and theater arts in America from colonial times to the beginning of the twentieth century. II; ¼ to 1 unit. Hewitt.

371. History and Principles of Literary and Rhetorical Criticism: Aristotle to Sidney. Same as English 371. I; ½ to 1 unit. Herrick.

372. History and Principles of Literary and Rhetorical Criticism: Sidney to the Present. Same as English 372. II; ½ to 1 unit. Herrick.

373. Phonetics and Phonemics. Methodologies of phonetics, with special application to English; general principles of phonemic interpretation. I or II; ½ to 1 unit. Prerequisite: Speech 301. Hultzén.

375. Speech Science. Introduction to anatomical and physiological characteristics of the normal speech mechanism. Demonstration in the speech laboratory. I; ½ to 1 unit. Prerequisite: Ten hours of speech; consent of instructor. Fairbanks.

376. Speech Science. Introduction to the acoustical characteristics of voice and speech sounds and to the physiology of the ear. Demonstration in the speech laboratory. II; ½ to 1 unit. Prerequisite: Speech 375. Fairbanks.

383. Psychological Disorders of Speech. Principles and methods of clinical and classroom correction of psychological disorders of speech, with special reference to stuttering and delayed speech; clinical and classroom practice with children and adults. I, II; 1 unit. Prerequisite: Consent of instructor. Wischner.

385. Speech Correction. Study of the causes, symptoms, and treatment of speech disorders, including articulatory, vocal, and rhythmical disorders; observation and practice in clinical techniques are provided in the laboratory. I; ½ to 1 unit. Prerequisite: Ten hours of speech, or consent of instructor. Nelson.

386. Clinical Practice. Case work and practice teaching in remedial speech. Must be taken concurrently with Speech 385. I; ½ unit. Nelson and staff.

388. Speech Correction. Study of causes, symptoms, and treatment of speech disorders, including stuttering, cerebral palsy, aphasia, and glandular disorders. II; ½ unit. Prerequisite: Speech 385. Nelson.

389. Clinical Practice. Case work and practice teaching in remedial speech. Must be taken concurrently with Speech 388. II; ½ unit. Nelson and staff.

391. Introduction to Hearing Disorders. Analysis of symptoms and causes of hearing losses; effects of hearing loss upon oral communication, education, and psychological adjustment; principles of retraining the hard-of-hearing.

I, II; ¼ to ½ unit. Prerequisite: Ten hours of speech; Speech 301; consent of instructor. TAYLOR.

393. AURAL REHABILITATION. Principles and methods of clinical and classroom retraining of the hard-of-hearing, including lip reading, auditory training, speech correction and conservation, counseling; clinical and classroom practice with children and adults. I, II; ¼ to ½ unit. Prerequisite: Speech 391; consent of instructor. Required in the curriculum of teacher training in speech correction. TAYLOR.

395. AUDIOMETRY AND THE USE OF HEARING AIDS. Selective and diagnostic tests of hearing, the planning and conduct of hearing conservation programs, general problems involved in the use of hearing aids. I, II; ½ to 1 unit. Prerequisite: Speech 376. CURRY, TAYLOR.

THEORETICAL AND APPLIED MECHANICS

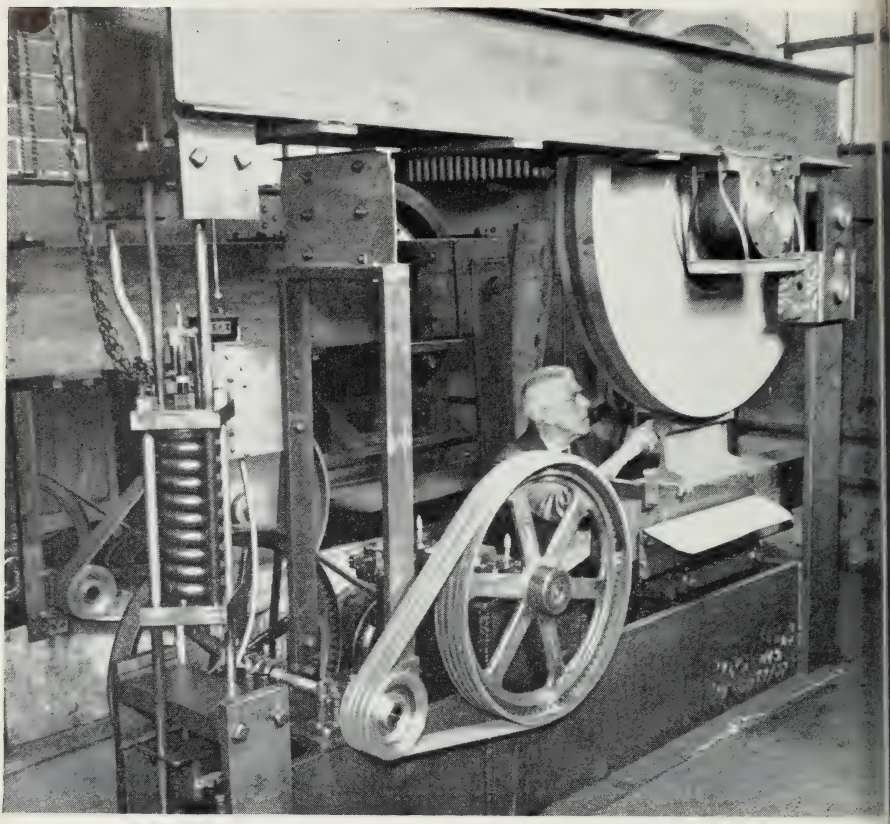
The Department of Theoretical and Applied Mechanics offers graduate work leading to the degree of Master of Science in Theoretical and Applied Mechanics and Doctor of Philosophy in Engineering.

In graduate work in the field of theoretical and applied mechanics emphasis is given mainly to the following topics: analytical and experimental methods of analysis of engineering problems; a study of the properties of materials and of the elastic and inelastic behavior of load-resisting members; a study of hydraulics and of fluid mechanics; and mechanical vibrations and other problems in the dynamics of bodies. Research is emphasized in the graduate work. Extensive research programs are conducted in special laboratories which are available for use by graduate students. These laboratories provide facilities for studies of fatigue of metals; stresses in railway rails and car wheels; creep properties and other inelastic behavior of materials; photoelastic, electric strain gage, and other methods of experimental stress analysis; constant humidity-temperature investigations of plastics; reinforced concrete members; static and dynamic tests of materials; vibrations of machines and structures; hydraulics and fluid mechanics, etc.

Graduate students electing theoretical and applied mechanics as their major must have had the equivalent of the undergraduate courses in mechanics required for a bachelor's degree in any of the curricula in the College of Engineering. The course prerequisites for a minor in theoretical and applied mechanics are, in general, the same as for a major, but with certain modifications depending on the student's interests and objectives. Students applying for admission must have a 3.5 grade-point average for that portion of the work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. Students on limited status will not be admitted. The course requirement for a minor for the Master of Science degree is one unit; for the Doctor of Philosophy degree, the requirement for a first minor is four units, and for a second minor two units.

Assistantships

Part-time assistantships in teaching and research are available. The general qualification is a high scholastic record. To make application for an assistantship in teaching or research, communications should be addressed to the Head of the Department.



Operation of a Rolling-Load Machine for Measuring the Strength of Railroad Rails

Graduate Teaching Faculty

Professors: F. B. Seely (Head of Department), W. L. Collins, T. J. Dolan, H. L. Langhaar, W. M. Lansford, W. J. Putnam, N. O. Myklestad, H. J. Schrader, W. L. Schwalbe, J. O. Smith.

Associate Professors: W. E. Black, W. N. Findley, P. G. Jones.

Assistant Professor: O. M. Sidebottom.

Courses for Graduates

421. Mechanics of Materials. Methods of obtaining relations between loads and stresses and strains in various members. The main topics covered in this course and the one which follows are: curved beams, unsymmetrical bending, thick-walled cylinders, beams on elastic supports, contact stresses, torsion of members with non-circular cross-section, stress concentrations, elastic energy methods applied to statically indeterminate members, flat plates, inelastic behavior of various types of members. Introduction to mathematical theory of elasticity; elastic and plastic buckling; criteria of failure by yielding and by fracture. I; ½ to 1 unit. Smith.

422. Mechanics of Materials. Continuation of Theoretical and Applied Mechanics 421. II; 1 unit. Prerequisite: Theoretical and Applied Mechanics 421. Smith.

424. Properties of Engineering Materials. Significance of properties under various conditions of loading and use, including static, creep and fatigue, and impact properties; tests and interpretation of test data. Methods of obtaining special combinations of properties. Effects of temperature, strain rate, internal structure, etc. Specifications of properties and materials. II; ½ to 1 unit. Collins.

427. Analytical Study of Experimental Work in Reinforced Concrete. A critical study of available results of tests of reinforced concrete members and structures, with particular attention to beams, frames and footings. I; 1 unit. Prerequisite: Introductory course in reinforced concrete.

428. Analytical Study of Experimental Work in Reinforced Concrete. Continuation of Theoretical and Applied Mechanics 427, with particular attention to columns and slabs. II; 1 unit. Prerequisite: Introductory course in reinforced concrete.

431. Applied Fluid Mechanics. A course designed to illustrate applications of dimensional analysis, the energy principle, and the momentum principle in practical analyses of flow problems. Dimensional analysis is developed systematically. It is employed to develop model laws, the von Karman theory of uni-directional turbulent flow, the correlation between the Chezy formula and the Darcy formula, and other topics. The energy principle is applied to problems of transient flow, the theory of gravity waves, and flow in open channels. The momentum principle is applied to the theory of open-channel flow, the theory of the hydraulic jump and the plane shock, and the theory of the boundary layer. I; 1 unit. Prerequisite: Theoretical and Applied Mechanics 232; one advanced mathematics course is desirable. Langhaar.

432. Theory of Flow of Incompressible Fluids. A course emphasizing topics in classical fluid mechanics which are the basis of many modern developments. The material consists of fundamentals of frictionless flow, Euler's differential equations of motion, velocity potentials, stream functions,

sources and sinks, complex potential functions, conformal mapping, Blasius' theorems of lift and moments, vortex motion line vortices and vortex sheets, stresses in viscous fluids, Navier-Stokes equations, and differential equations of the boundary layer. II; 1 unit. Prerequisite: Theoretical and Applied Mechanics 232; one advanced mathematics course is desirable. LANGHAAR.

451. THEORY OF ELASTICITY WITH APPLICATION TO ENGINEERING PROBLEMS. A study of the mechanics of elastic deformable bodies, based on the fundamental concepts of equilibrium, geometry of strain and properties of materials. Relations between stresses, strains, and displacements are studied in detail with special consideration given to their significance in engineering problems. I; 1 unit. MYKLESTAD, NEWMARK.

452. THEORY OF ELASTICITY WITH APPLICATION TO ENGINEERING PROBLEMS. Continuation of Theoretical and Applied Mechanics 451. II; 1 unit. Prerequisite: Theoretical and Applied Mechanics 451. MYKLESTAD, NEWMARK.

461. INELASTIC BEHAVIOR OF ENGINEERING MATERIALS. An outline of a general theory of inelastic behavior. A study of the mechanisms of inelastic action involving viscosity, plasticity, and fracture in relation to yielding or flow, creep, fracture under repeated loads and under impact. Relation of inelastic behavior to planning of tests, to the interpretation of test results and to design. I; ½ to 1 unit. Prerequisite: One year of graduate work. SMITH.

462. INELASTIC BEHAVIOR OF ENGINEERING MATERIALS. Continuation of Theoretical and Applied Mechanics 461. II; 1 unit. Prerequisite: Theoretical and Applied Mechanics 461. SMITH.

491. THESIS. I; 1 to 2½ units. STAFF.

492. THESIS. II; 1 to 2½ units. STAFF.

493. SPECIAL PROBLEMS. Individual investigation of studies, either analytical or experimental, in one or more phases of theoretical and applied mechanics, including mechanics of materials, theory of elasticity, properties of materials, mechanical vibrations, hydraulics and fluid mechanics, etc. I; ½ to 2 units. STAFF.

494. SPECIAL PROBLEMS. Individual investigation of studies, either analytical or experimental, in one or more phases of theoretical and applied mechanics, including mechanics of materials, theory of elasticity, properties of materials, mechanical vibrations, hydraulics and fluid mechanics, etc. II; ½ to 2 units. STAFF.

Courses for Graduates and Advanced Undergraduates

311. MECHANICAL VIBRATIONS. Kinematics of vibratory motion. Comprehensive study of motion having single degree of freedom. Critical speeds of shafts; vibration of systems with several degrees of freedom. Applications to engineering problems. I, II; ½ to 1 unit. Prerequisite: Theoretical and Applied Mechanics 154 or 156 or 211 and 221. JONES, MYKLESTAD.

312. MECHANICAL VIBRATIONS. Continuation of Theoretical and Applied Mechanics 311. Problems in bending and torsional vibrations. Special problems. II; ½ to 1 unit. Prerequisite: Theoretical and Applied Mechanics 311. MYKLESTAD.

321. ADVANCED MECHANICS OF MATERIALS. Methods used in elementary mechanics of materials are expanded and generalized and used to solve more complex problems. Thick-walled cylinders, torsion of bar having non-

circular cross-section; curved beams, unsymmetrical bending, flat plates; theories of failure. I, II; ½ to 1 unit. Prerequisite: Theoretical and Applied Mechanics 221 and 223. BLACK, SMITH.

323. ADVANCED LABORATORY IN MATERIALS TESTINGS. Calibration of testing machines and of strain measuring instruments. Use of various mechanical and electrical strain gages. Interpretation of test results. Relation of tests to specifications of materials. I, II; ½ to 1 unit. Prerequisite: Theoretical and Applied Mechanics 221 and 223. COLLINS, PUTNAM.

326. EXPERIMENTAL STRESS ANALYSIS. Methods of extending and applying basic physical laws to the measurement of stresses or deformations that are of significance in the engineering design of load resisting members. Systematic applications of optical, electrical, and physical properties of matter to the instrumentation and measurement of model or prototype stresses. Among the topics studied are: photoelasticity, significant mechanical characteristics of materials, accuracy vs. sensitivity of measurement, dynamometers, and strain measuring devices, measurement of vibration stresses, models and analogies, brittle coatings, electrical resistance gages, etc. I, II; ½ to 1 unit. Prerequisite: Theoretical and Applied Mechanics 221 and 223; 321 desirable. DOLAN.

334. FLUID MECHANICS AND ADVANCED HYDRAULICS. A study of the basic properties of fluids in general, particularly those that influence the flow of fluids in pipes and open channels, viscosimetry, dimensional analysis, effect of boundary conditions, cavitation, water tunnel, hydraulic jump, water hammer, pumps, turbines. Some laboratory work. II; ½ to 1 unit. Prerequisite: Theoretical and Applied Mechanics 232 and 234. LANSFORD.

VETERINARY PATHOLOGY AND HYGIENE

Graduate students who choose veterinary pathology and hygiene as a major must be graduates of a recognized veterinary college. Students applying for admission must have a grade-point average of at least 3.5 for that portion of the work which represents the last fifty per cent of the hours completed to secure the bachelor's degree, exclusive of required physical education and military training. In certain cases graduate students may be accepted on limited status. Students whose major is in a related field may register for a minor in veterinary pathology and hygiene.

The Master of Science and Doctor of Philosophy degrees are offered in veterinary pathology and hygiene. Candidates for the master's degree must pass a reading knowledge examination in one foreign language in addition to satisfying the other requirements of the Graduate College for this degree.

Assistantships

Teaching and research assistantships are available for selected graduate students. Applications for assistantships should be directed to the Dean of the College of Veterinary Medicine.

Graduate Teaching Faculty

Professors: R. GRAHAM (Head of Department), L. E. BOLEY, C. C. MORRILL, J. SAMPSON, L. E. ST. CLAIR.

Associate Professors: J. O. ALBERTS, N. D. LEVINE.

Courses for Graduates

401. Laboratory Diagnostic Methods in Veterinary Pathology. Diagnosis of the animal diseases caused by bacteria, filtrable viruses, and fungi. I; 1 unit. Prerequisite: Bacteriology 326, or equivalent. Alberts, Graham.

402. Laboratory Diagnostic Methods in Veterinary Pathology. Diagnosis of animal diseases caused by parasitic protozoa, helminths, arthropods, metabolic disturbances, and poisonous plants. II; 1 unit. Levine, Sampson.

404. Seminar. Required of all graduate students whose major is veterinary pathology and hygiene. I, II; ¼ unit. Graham, Levine.

405. Advanced Veterinary Pathology. Advanced study of gross and microscopic pathology of diseases of domestic animals. I; 1 unit. Morrill.

406. The Experimental Method in Veterinary Research. Planning of experiments, use of controls, interpretation of results, sources of error, and writing the research report. Lectures and discussion. I; ¼ unit. Levine.

493. Research. Assigned problems of research in veterinary pathology, histology, physiology, parasitology, and bacteriology. I; ½ to 2 units. Alberts, Boley, Graham, Levine, Morrill, St. Clair, Sampson.

494. Research. Assigned problems of research in veterinary pathology, histology, physiology, parasitology, and bacteriology. II; ½ to 2 units. Alberts, Boley, Graham, Levine, Morrill, St. Clair, Sampson.

Courses for Graduates and Advanced Undergraduates

332. Principles of Sanitation in the Processing and Handling of Foods. Same as Food Technology 332. A study of the principles of sanitation with appropriate emphasis on practical considerations as they apply to various food processing industries. Control of insects, rodents, and microorganisms; fundamentals of detergency; sanitation of water supplies; waste disposal methods. Government and public health regulations. Local field trips to food processing plants. II; 1 unit. Prerequisite: Bacteriology 104 and 105, Chemistry 132, or equivalents. Ordal.

ZOOLOGY

The Department of Zoology offers work leading to the degrees of Master of Science and Doctor of Philosophy.

Graduate students who choose zoology as a major must have had at least two years of undergraduate work in zoology, except that under special circumstances advanced courses in closely allied subjects may be accepted in place of the fourth semester of zoology. Students applying for admission must have a 3.75 grade-point average for that portion of the work which represents the last fifty per cent of the hours earned toward the bachelor's degree, exclusive of required courses in physical education and military training. Students on limited status will not be admitted.

Graduate students in other departments who choose zoology as a minor must have had at least one year of undergraduate work in zoology or ten hours of any laboratory science.

A reading knowledge of German and French is indispensable for graduate study in zoology, and familiarity with Latin and Greek is of great advantage.

Graduate students whose major is zoology are strongly advised to study at

least one summer at a marine biological station. Every candidate for the Doctor of Philosophy degree in zoology is required to furnish evidence of having completed satisfactorily at least six weeks of work at an approved station.

Although no special degree in wildlife management is offered, students may prepare themselves for that type of work by selecting courses from the following list: Zoology 304, 318, 321, 335, 336, 337, 338, 343, 345, 418, 421, 441, 445, 446, and research courses. Such students should choose their minors from botany, physiology, entomology, and bacteriology.

For the degree of Master of Science in the Biological Sciences or in the Teaching of the Biological Sciences and General Science, see page 53.

Special information relating to departmental standards and requirements is furnished by the Department and may be obtained by writing to the Head of the Department, 345 Natural History Building.

Assistants

A limited number of one-fourth and one-half time graduate teaching assistantships are available in the Department. Inquiries concerning such appointments should be directed to the Head of the Department, 345 Natural History Building.

Graduate Teaching Faculty

Professors: F. B. Adamstone (Head of Department), S. C. Kendeigh, R. R. Kudo, L. J. Thomas (on leave second semester 1950-1951), H. J. Van Cleave.

Associate Professors: B. V. Hall, L. Ingle, W. M. Luce, S. M. Rose.

Assistant Professors: H. I. Fisher, D. F. Hoffmeister, O. E. Kugler, M. R. Matteson, H. H. Shoemaker, H. M. Smith.

Instructor: J. B. Kitzmiller.

Courses for Graduates

403. Cytology. Structure and organization of the animal cell. I; 1 unit. Prerequisite: Consent of instructor. Adamstone.

409. History of Zoology. The development of zoological science as a specialized field of human knowledge. I; ½ to 1 unit. Rose.

418. Advanced Protozoology. Detailed morphological, physiological, and developmental studies of human protozoa and certain other important forms; introduction to, and practice of, technique. II; 1 unit. Prerequisite: Zoology 318. Kudo.

419. Experimental Protozoology. Experimental methods for study of problems in growth, multiplication, nuclear phenomena, and regeneration in protozoa. I; 1 unit. Prerequisite: Zoology 418. Kudo.

422. Parasitology-Helminthology. Advanced study of modern methods in helminthology. II; 1 unit. Prerequisite: Zoology 321, Bacteriology 327, or equivalent. Thomas.

424. Invertebrate Taxonomy. Individual problems in taxonomy of invertebrates. II; ½ to 1 unit. Prerequisite: Zoology 304. Offered in 1951-1952 and in alternate years. Matteson.

432. Classification, Phylogeny, and Evolution of Vertebrates. I; 1 unit. Prerequisite: Zoology 132; graduate standing in zoology. Offered in 1951-1952 and in alternate years. Hall.

433. Embryology. I; 1 unit. Prerequisite: Zoology 333. Rose.

435. Advanced Ornithology. Seminar on modern techniques, concepts, and problems. I; ½ unit. Prerequisite: Zoology 335, or equivalent. Offered in 1950-1951 and in alternate years. Kendeigh.

441. Advanced Field Ecology. Field studies of ecological communities, mammals, birds, and invertebrates in (for example) Great Smoky Mountains National Park, Eastern Tennessee. S; ½ to 1 unit. Kendeigh.

445. Advanced Ecology and Wildlife Management. Seminar on modern techniques, concepts, and problems. I; ½ unit. Prerequisite: Zoology 345, or equivalent. Offered in 1951-1952 and in alternate years. Kendeigh.

446. Physiological Ecology. Physiological adjustments and responses of organisms to their environment. II; 1 unit. Kendeigh.

455. Advanced Genetics. The gene in heredity, development, and evolution. I; 1 unit. Luce.

456. Physiological Genetics. The nature of the gene and its action in the developmental and physiological processes of the organism. II; 1 unit. Luce.

462. Advanced General Physiology Seminar. Same as Physiology 462. Lectures, reports, and discussions. Topic for 1951-1952: Physiological Adaptations as Evolutionary Factors. I or II; ½ unit. Prerequisite: Physiology 362, or equivalent. (Not offered in 1950-1951. Students should register in Physiology 333.) Prosser.

467. Experimental Embryology. II; 1 unit. Prerequisite: Zoology 433. Rose.

493. Individual Research. I; 1 to 2 units.

494. Individual Research. II; 1 to 2 units.

Work in the following fields is offered for students registered in Zoology 493 or 494:

Animal Ecology, Ornithology, and Wildlife Management — Kendeigh.

Chemical Embryology — Kugler.

Genetics and Regeneration — Luce.

Genetics and Evolution — Kitzmiller.

Herpetology — Smith.

Histology and Cytology — Adamstone.

Ichthyology and Fish Management — Shoemaker.

Invertebrate Zoology and Parasitology — Ingle, Matteson, Van Cleave.

Limnology — Matteson.

Mammalogy — Hoffmeister.

Ornithology and Avian Anatomy — Fisher.

Parasitology and Helminthology — Thomas.

Physiological Zoology — Prosser.

Protozoology and Parasitology — Kudo.

Vertebrate Embryology — Rose.

Vertebrate Zoology — Hall.

Courses for Graduates and Advanced Undergraduates

NOTE: Graduate students ordinarily receive ¼ unit credit in the following courses, but may receive ½ unit if extra work is done: 306, 334, 335, 336, 337, 338, 342, 343, 351, and 352. In Zoology 320 and 332, graduate students ordinarily receive ½ unit credit, but may receive 1 unit if extra work is done.

300. GENERAL SEMINAR. For members of the staff and graduate students. Also open to seniors whose major is zoology. I; no credit. Attention is called to the following special clubs and seminars, some of which are interdepartmental: Animal Ecology Club, Genetics Seminar.

301. GENERAL SEMINAR. For members of the staff and graduate students. Also open to seniors whose major is zoology. II; no credit. Attention is called to the following special clubs and seminars, some of which are interdepartmental: Animal Ecology Club, Genetics Seminar.

302. INDIVIDUAL TOPICS. For those who wish to study individual problems. Candidates for honors and undergraduates who are enrolled for tutorial work or in individual curricula should register in this course. Graduates may register for topics involving individual work not assigned in other courses. Laboratory, conferences, and readings. I; ½ to 1 unit. Prerequisite: Two years of zoology; approval of department. STAFF.

303. INDIVIDUAL TOPICS. For those who wish to study individual problems. Candidates for honors and undergraduates who are enrolled for tutorial work or in individual curricula should register in this course. Graduates may register for topics involving individual work not assigned in other courses. Laboratory, conferences, and readings. II; ½ to 1 unit. Prerequisite: Two years of zoology; approval of department. STAFF.

304. FIELD ZOOLOGY. Collection, preservation, and identification of lower vertebrates and fresh water invertebrates; habits and life histories of selected forms. I; ½ to 1 unit. Prerequisite: One year of zoology, or equivalent. MATTESON.

306. BIOLOGY FOR TEACHERS. Same as Botany 306. A teacher-training and review course for those engaged in or preparing for teaching general biology in high school. II; ¼ unit. Prerequisite: Botany 100; Zoology 101. FULLER, MATTESON.

318. PROTOZOOLOGY. Morphology, taxonomy, physiology, and life history of representative free-living and parasitic protozoa. I, II; 1 unit. Prerequisite: One year of zoology, or equivalent. KUDO.

320. INVERTEBRATE ZOOLOGY. Invertebrates; structure and development. Application of biological principles. Specific and comparative morphology of the invertebrates; coordination of structure and function, origin, development, and life histories. II; ½ to 1 unit. Prerequisite: Zoology 101. INGLE.

321. PARASITOLOGY — HELMINTHOLOGY. Worm parasites, life cycles, morphology, taxonomy, environmental relations. Lecture, laboratory, technic, readings, quiz, demonstrations, problems. I, II; ½ to 1 unit. Prerequisite: Zoology 132. THOMAS.

332. ADVANCED VERTEBRATE ZOOLOGY. Vertebrate morphology: comparative anatomy, evolution and function of vertebrate organ systems, with special emphasis on the evolution, anatomy, and function of the skeletal and nervous systems. Lectures and laboratory. I; ½ unit. Prerequisite: Zoology 333. Offered in 1950-1951 and in alternate years. HALL.

333. Vertebrate Embryology. The development of the vertebrate body and its organs. I, II; ½ unit. Prerequisite: Zoology 132. Adamstone.

334. Vertebrate Histology. Study and preparation of tissues of the vertebrate body. II; ¼ unit. Prerequisite: Zoology 333, or consent of instructor. Adamstone.

335. Ornithology. Structure, functions, environmental relations, habits, life history, and identification of birds. II; ¼ unit. Prerequisite: Zoology 101 or 104. Fisher, Kendeigh.

336. Mammalogy. Classification, distribution, life history, evolution, and identification of mammals. Lecture, laboratory, and field work. I; ¼ unit. Prerequisite: Zoology 132. Offered in 1951-1952 and in alternate years. Hoffmeister.

337. Ichthyology. Classification, structure, evolution, distribution, and life history of fishes. Lectures, laboratory, and field work. I; ¼ unit. Prerequisite: Zoology 132. Offered in 1950-1951 and in alternate years. Shoemaker.

338. Herpetology. Classification, distribution, life history, and identification of reptiles and amphibia, particularly those of the United States. Lectures, laboratory, and field work. II; ¼ unit. Prerequisite: Zoology 132. Offered in 1951-1952 and in alternate years. Smith.

341. Field Ecology. Study of biotic communities, birds, and fish in the vicinity of Reelfoot Lake, Tennessee, covering six days. Students may enroll in subsequent years for additional credit by specializing in different fields of study. II; ¼ to 1 unit. Prerequisite: Enrollment in Zoology 240, or 335, or equivalent. Kendeigh, Shoemaker.

342. Wildlife Management and Conservation. Size and measurement of animal populations, factors affecting reproduction and mortality, life history, management policies for fishes, mammals, and birds. I; ¼ unit. Prerequisite: Zoology 101 or 104. Shoemaker.

343. Limnology. Study of the lake, pond, and river with emphasis on the physical environment as well as on the plants and animals which live in fresh water. Lectures, discussions, laboratory, and field work. II; ¼ unit. Prerequisite: Zoology 101, or Botany 100 and 101. Offered in 1950-1951 and in alternate years. Matteson.

345. Animal Ecology and Geography. Dynamics, development, and distribution of biotic communities. I; ½ to 1 unit. Prerequisite: One year of zoology. Kendeigh.

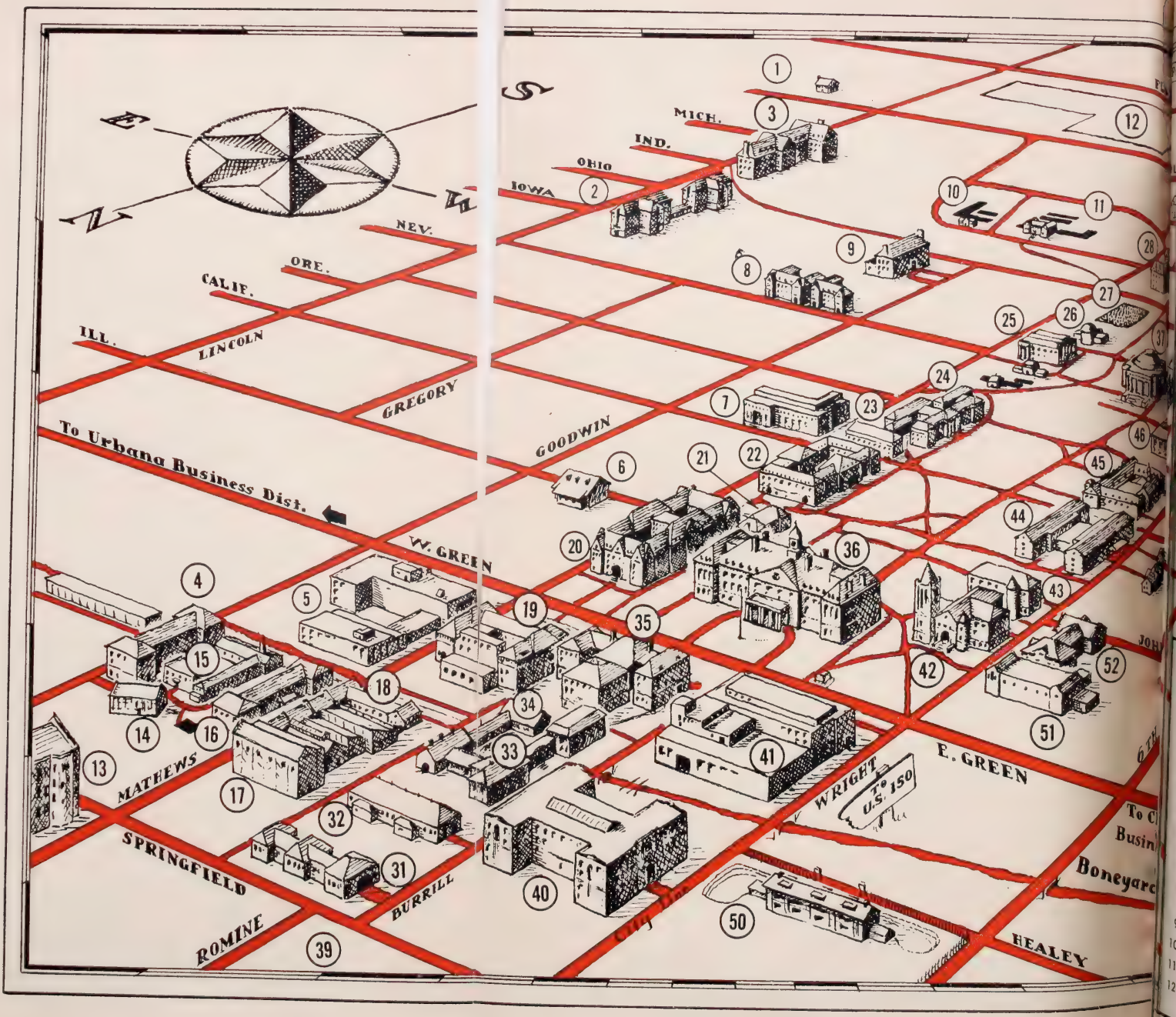
351. Genetics. Principles of heredity. Lectures, readings, and discussions. II; ¼ unit. Prerequisite: Zoology 101 or 104, or one semester of any biological science. Luce.

352. Genetics. Laboratory experiments illustrating the principles of heredity, problems, demonstrations. II; ¼ unit. Prerequisite: Credit or registration in Zoology 351. Kitzmiller, Luce.

361. Comparative Physiology. Same as Physiology 361. A comparison of the general physiology of different groups of animals. I; 1 unit. Prerequisite: Three semesters of zoology, or two of zoology and one of physiology. Elementary physiology and chemistry are recommended. Prosser.

362. Cellular Physiology. Same as Physiology 362. A physico-chemical analysis of biological functions common to most living cells. II; 1 unit. Prerequisite: One year of biology; three semesters of chemistry. Elementary physics is recommended. Prosser.

363. Endocrinology. Same as Physiology 363. The glands of internal secretion with special reference to the vertebrates. I; ½ unit. Prerequisite: One semester of elementary zoology or physiology; Zoology 334, or organic chemistry. Hall.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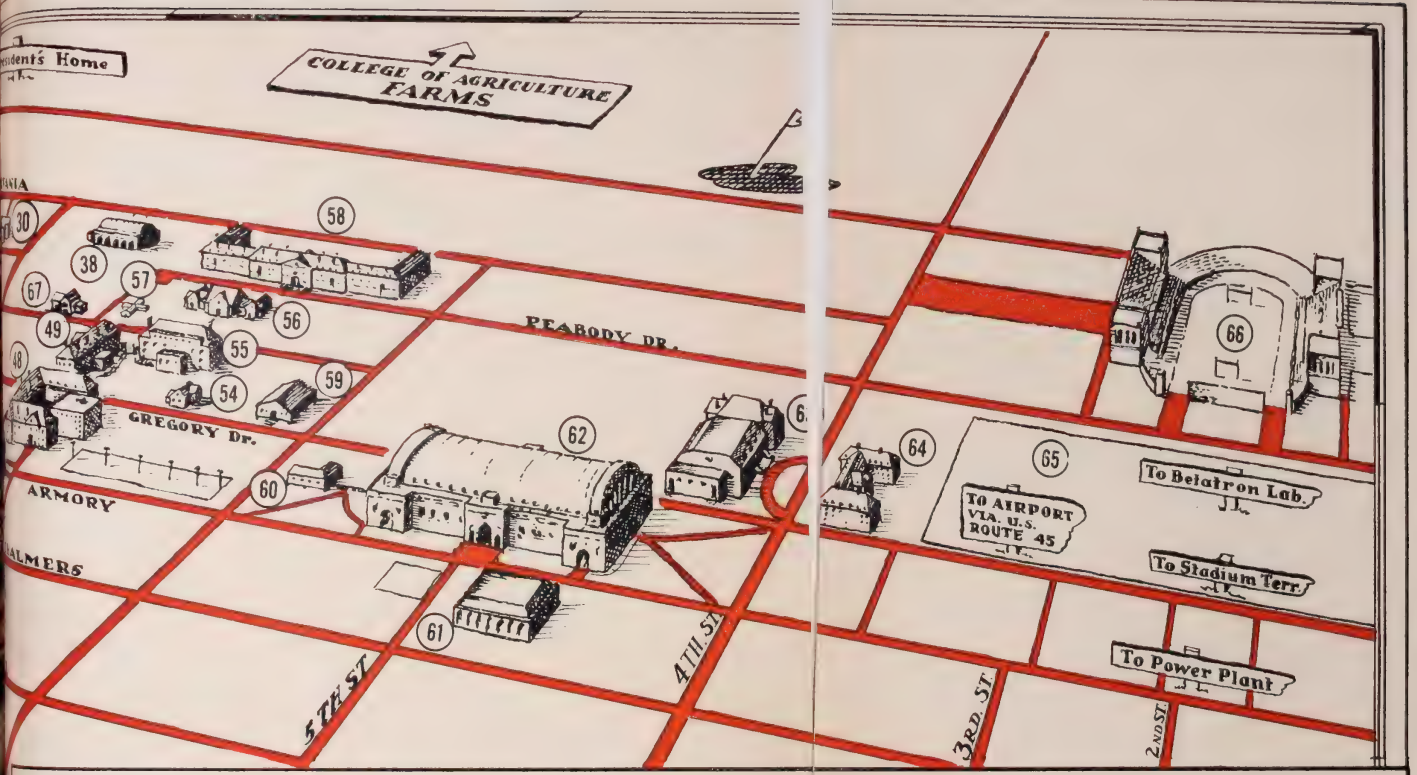

UNIVERSITY OF ILLINOIS CAMPUS AT URBANA-CHAMPAIGN

1 Veterinary Research Center
2 Lincoln Avenue Residence
3 McKinley Hospital
4 Ceramics Building
5 Mechanical Engineering Building
6 University Club, Men's
7 East Chemistry Building
8 Busey and Evans Residence Halls for Women
9 Woman's Gymnasium
10 Vegetable Crops Building
11 Floriculture Building
12 Illini Village
13 University High School
14 Aeronautical Engineering Laboratory
15 Mining and Metallurgical Laboratory
16 Transportation Building
17 Physical Plant Service Building
18 Mechanical Engineering Laboratory
19 Physics Building
20 Natural History Building
21 Harker Hall
22 Noyes Chemical Laboratory
23 Chemistry Annex
24 Davenport Hall
25 Smith Memorial Music Hall
26 Observatory
27 Morrow Plots
28 Mumford Hall
29 Agricultural Engineering Building
30 Dairy Manufactures Building
31 Woodshop and Foundry
32 Machine Tool Laboratory
33 Electrical Engineering Research Laboratory and Annex
34 Fire Station
35 Civil Engineering Hall
36 Illini Union Building
37 Auditorium
38 Stock Judging Pavilion
39 Men's Old Gymnasium and Annex
40 Talbot Laboratory
41 Electrical Engineering Building
42 Altgeld Hall
43 Mathematics Building
44 Administration Building
45 Bevier Hall
46 Lincoln Hall
47 Gregory Hall
48 Library
49 David Kinley Hall
50 Vivarium
51 Arcade Building
52 Illini Hall
53 Davenport House
54 Civil Engineering Surveying Building
55 Architecture Building
56 Veterinary Pathology Laboratory
57 Veteran's Recreation Building
58 Natural Resources Building
59 Illini Union Coffee House
60 Band Building
61 Ice Skating Rink
62 Armory
63 George Huff Gymnasium
64 Men's Residence Hall
65 Parade Ground Housing Units
66 Stadium
67 Mumford House

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